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Volume 71

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The CANADIAN FIELD-NATURALIST

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OTTAWA ONTARIO

THE OTTAWA FIELD-NATURALISTS' CLUB

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The Canadian Field-Naturalist

VOLUME 71 JANUARY-MARCH 1957 NUMBER 1

SOME OBSERVATIONS ON MAMMALS IN THE AREA BETWEEN COPPERMINE AND POND INLET, N.W.T., DURING 1954 AND 1955

Derek V. Ellis

Zoology Department, McGill University, Montreal, Quebec

Received for publication March 5, 1956

During the course of an expedition to the region between Coppermine and Pond Inlet (see map) from May 1954 to August 1955, I was able to make a series of observations on several species of mammals.

The first descriptions of the mammals in this region are included in the journals of the Hudson's Bay Company and Royal Navy explorers; these are listed in Baird (1949). The early reports have been extended by Freuchen (1935) in north Baffin Island and Foxe Basin, by Gavin (1945) at Perry River, Queen Maud Gulf, and by Miller (1955) near Pond Inlet. There are many other records of the mammals from more western and southern arctic regions but of these only the notes of Manning (1943) in Foxe Basin overlap the area of the present observations.

In the region covered here, which is near the northern limits of the range of some species, there is still a considerable lack of detailed information on the distribution of the mammals, especially the rodents, and also on the biology of the marine species. The observations here are concerned chiefly with these two subjects.

The main interest of the expedition was in collecting marine benthos; the program will be described elsewhere. However two species of mammals, the walrus *Odobenus rosmarus* and the square flipper *Erignathus barbatus,* have particular interest in the study of the ecology of the sea bottom because they feed almost entirely upon the marine benthos. Accordingly observations on these species were made whenever possible.

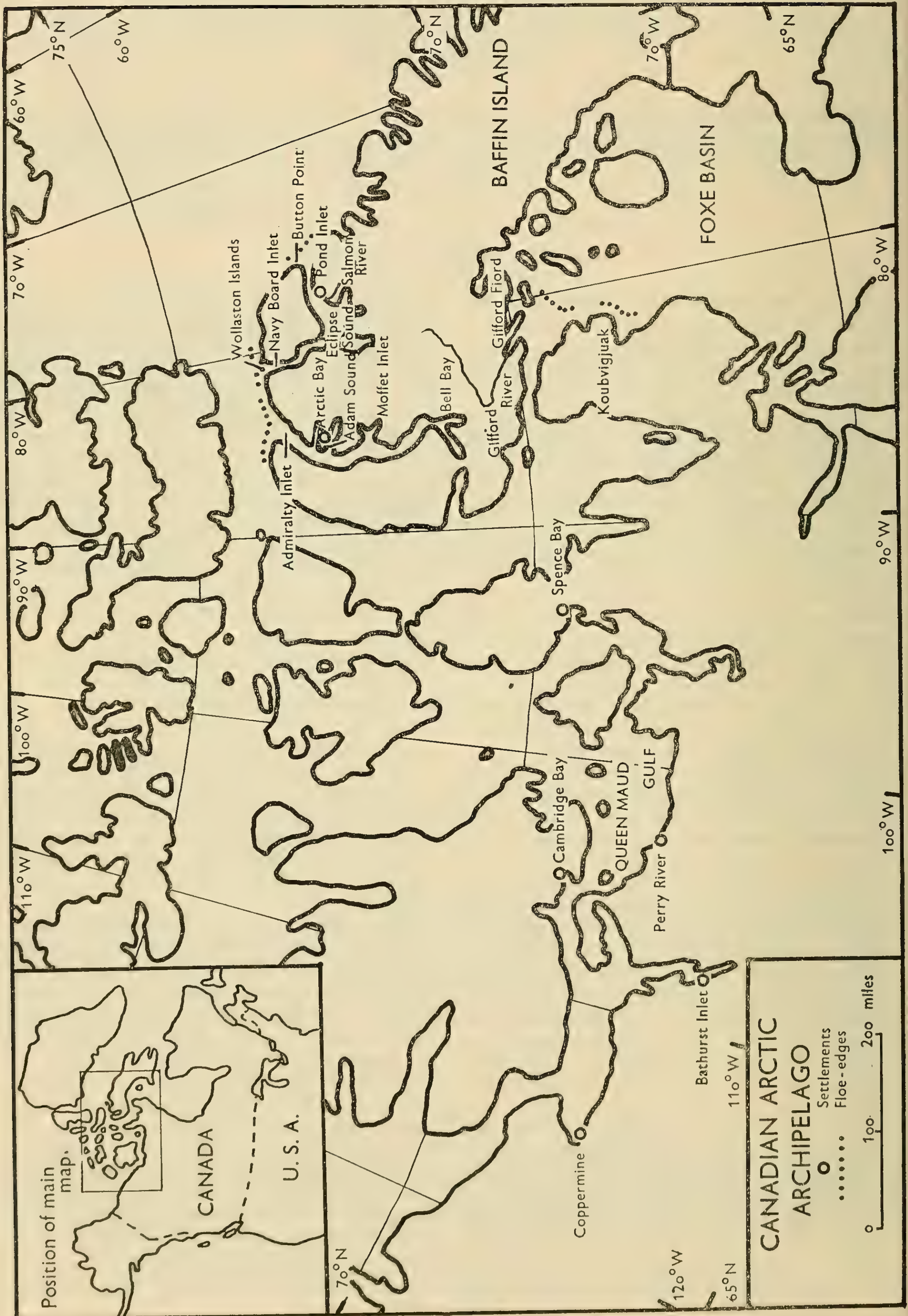
In order to collect benthos, plankton and other specimens it was necessary to travel extensively with the Eskimo by boat and dog sled. The Eskimo of the regions visited rely to a great extent upon the jar seal *Phoca hispida* for food and consequently we hunted this seal on all possible occasions. As a result about 100 specimens were examined. The measurements and preserved material from these seals have been passed to Mr. Ian McLaren, Fisheries Research Board of Canada, for comparison with his data from south Baffin Island.

As most of the traveling was by boat or by dog sled over sea ice, there was little opportunity to encounter terrestrial mammals. Nevertheless a few were collected and the prepared skins have been deposited in the National Museum of Canada, Ottawa; the Redpath Museum, McGill University, Montreal; and the Zoology Museum, University of Copenhagen, Denmark.

These notes follow in general the scientific nomenclature and systematic arrangement in Anderson (1946) but the common names are those used by the white residents in the arctic settlements visited. In some cases they differ from the common names in use outside arctic Canada. Eskimo names are not given because there is too great a variation arising from local dialects. As most of these observations are based on sight records the identifications are to species only and not to subspecies.

The expedition was financed by grants from the Banting Fund and the Arctic Institute of North America. Subsequent laboratory work on the collections, and the preparation of these notes for publication, has been made possible by scholarships from the National Research Council. I wish to express my gratitude for this support, for the advice and information from Mr. Ian McLaren about the biology of the marine mammals and for the hospitality and assistance I received from the Eskimo and white residents in the arctic. I am also grateful to Dr. Magnus Degerbøl, Zoology Museum, University of Copenhagen, for critical advice while I prepared these notes for publication.

The Canadian Field-Naturalist for October-December 1956 (Can. Field Nat. 70: 149-196, 1956) was issued June 14, 1957.


CANADIAN ARCTIC
ARCHIPELAGO
Settlements
Floe-edges
0
100
200 miles
Position of main map.
CANADA
U. S. A.
BAFFIN ISLAND
FOXE BASIN
QUEEN MAUD
GULF
Button Point
Navy Board Inlet
Wollaston Islands
Pond Inlet
Salmon River
Eclipse Sound
Arctic Bay
Adam Sound
Moffet Inlet
Bell Bay
Gifford Fiord
Gifford River
Koubvigjuak
Admiralty Inlet
Spence Bay
Cambridge Bay
Perry River
Bathurst Inlet
Coppermine
75°N
70°N
65°N
60°W
70°W
80°W
90°W
100°W
110°W
120°W

POLAR BEAR *Thalarctos maritimus* (Phipps)

1954. A single bear was seen asleep on a small piece of drift ice in the Queen Maud Gulf on August 24.

1955. Fresh tracks were seen occasionally during the winter and spring in Admiralty Inlet and near Button Point.

ARCTIC FOX *Alopex lagopus* (L.)

1954. Single animals and tracks were seen occasionally near Coppermine, Bathurst Inlet, Cambridge Bay and Arctic Bay. *A. lagopus* was abundant during the winter along the shores of Admiralty Inlet. In the immediate vicinity of Arctic Bay and near the mouth of the Inlet the Eskimo set traps along the shores but did not travel inland. From November to March (the legal trapping season) the foxes were taken almost anywhere along the coast but were trapped most frequently where small valleys opened out to the Inlet. These valleys were presumably used by the foxes as routes between the inland plateau and the sea ice.

1955. Fox tracks were common inland south of Moffet Inlet and between Bell Bay and the Gifford Fiord. In that low-lying region the foxes remained inland all winter whereas in the region around the mouth of Admiralty Inlet (which is bounded by high, steep cliffs) the foxes seemed to be concentrated along the shores.

Fresh tracks were also seen on the sea ice near the floe edges at Koubvigjuak, Admiralty Inlet, Navy Board Inlet and Button Point, usually near bear tracks or where seals and walruses had been cut up on the ice by the Eskimo.

Very few blue-phase foxes occurred in the Admiralty Inlet region. Of thirty foxes which I saw during the winter only one was a blue-phase individual.

On April 9 as my Eskimo guide and I traveled overland near Arctic Bay we crossed a line of large fox tracks; he insisted these were made by a red fox *Vulpes fulva* (Desmarest). This is considerably farther north than this species is generally believed to occur.

WOLF *Canis lupus* L.

1954. Three wolves appeared near Coppermine on May 22, 23 and 24, and fed on the settlement's garbage, which during the winter had been dumped on the sea ice offshore.

1955. A single line of fresh tracks was seen along the shore of the Gifford Fiord on March 10.

WEASEL *Mustela erminea* L.

1954. Individuals were seen occasionally at Cambridge Bay and Spence Bay and tracks were seen near Arctic Bay.

1955. Tracks were seen on land south of Moffet Inlet and along the shore in Bell Bay in January.

JAR SEAL (= Ringed seal) *Phoca hispida* Schreber

Movements in open water during summer. In the western arctic region during 1954 single seals appeared occasionally near Coppermine, Cambridge Bay and Spence Bay. In addition, groups of about 6 to 12 seals were seen frequently amongst drifting ice. These groups were invariably accompanied by many gulls and terns feeding at the surface and it is possible that the birds and seals were attracted by a supply of food, which in some way was related to the presence of drift ice. Several groups of seals were also seen in the completely ice-free Bathurst Inlet on August 4.

In north Baffin Island during September and October, 1954, there were many seals in Adam Sound and in the bays off Moffet Inlet. The Eskimo said that the seals were then copulating but as most of the females examined had fetuses, pairing must have taken place previously.

In 1955 seals appeared in the open water around the mouth of the Salmon River on July 12 before the ice in Eclipse Sound had begun to break. From July 25 the ice started to move extensively and thereafter seals frequently appeared near Pond Inlet settlement.

Movements beneath the ice during winter. In Adam Sound during October and November the breathing holes of the seals were scattered everywhere on level patches of ice. The holes were then very easy to find as they were covered by a small dome of thin ice about 6 inches in diameter, penetrated by a hole about 1 inch wide which permitted the exchange of air. In December it became increasingly more difficult to find the holes, probably because continuous hunting had killed off many of the seals and the remaining holes were buried under packed snow.

In Admiralty Inlet during the monthly periods of spring tides cracks appeared in the sea ice stretching out from the shore distances from a few hundred yards to many miles. Through December and January the seals' breathing holes were found frequently in these cracks after they froze over, and rarely in the level ice. As the cracks formed the seals must have deserted their previous holes in order to utilize the temporary easy access to the air. When the crack refroze a row of breathing holes developed there. These holes were then very easy to find simply by walking along the tide cracks.

The breathing holes generally occurred within a mile or so of the shore in Admiralty Inlet, but they were scattered throughout the narrower Adam Sound. The seals did not extend over the very deep water in the center of the Inlet although they were taken over similarly deep water in Adam Sound.

Distribution of seals during winter. The seals collected during the winter fall into three fairly distinct groups according to size and locality. The smallest and youngest seals — lengths, from the tip of nose to base of tail, between 2 ft. 6 in. and 3 ft. 6 in. — were generally shot at the floe edges. They spent the winter cruising along the floe edge, frequently in small groups, making only occasional breathing holes in thin ice when low temperatures and calm weather caused fresh ice to form beyond the previous floe edge. The middle-sized seals, between 3 ft. 6 in. and 4 ft. long, were mainly mature and were generally found close to shore at the mouth of Admiralty Inlet and near Button Point. The largest seals, usually more than 4 ft. long were taken in the bays of Moffet Inlet and in Adam Sound. In these two regions the ice formed early and remained solid until break-up the following summer, whereas the ice in the other regions was much less stable and tended to break early in the spring.

In general the largest seals were found where the ice conditions were most stable. This agrees with McLaren's observations in south Baffin Island (personal communication). McLaren maintains that the stability of the ice is a factor influencing the distribution and the success of breeding of the jar seal.

Feeding habits. The contents of 16 stomachs are included in the collections. From these stomachs and many others examined during the year, it is clear that the jar seals eat both crustacea and fish. During the winter many of the stomachs contained fish or at least their otoliths, but during the summer the stomachs frequently contained amphipods (Lysianassids ?) and other crustacea. The subject will be more fully dealt with by McLaren.

The period spent sleeping on the ice. On October 18, 1954, a few patches of newly formed ice were strong enough to support sleeping seals; at one time 44 were visible in Adam Sound. On that day the air temperature was about 10°F and the sun was hidden by clouds. The Eskimo said that the seals had had little sleep all summer and it was their first opportunity for a long time to sleep soundly.

On March 21, 1955, my guide and I saw a young seal on the ice in the southern part of Admiralty Inlet. It was a sunny day with few clouds and the air temperature was between —20° and 0°F. The seal was restless and not sleeping. A few seals appeared on the ice between April 18 and 29 near the floe edges in Admiralty Inlet and Navy Board Inlet. From May 13 there was a gradually increasing number of them on the ice near Button Point. In June, on a fine day, 30 or 40 seals could usually be seen, with fewer visible on cloudy days or at 'night.' In Eclipse Sound near Pond Inlet settlement the seals came onto the ice in large numbers only after July 11, almost the same day that they were first noticed in the open water at the mouth of the Salmon River. They were possibly individuals which had not wintered in the vicinity of the settlement but had arrived there during July as the ice began to crack extensively.

Whelping period. Baby jar seals (whitecoats) were first reported by the Eskimo on April 9. I saw two on April 14 and 16. An almost full-term fetus was taken by an Eskimo on April 15. Evidently the whelping period in 1955 extended from about April 9 to at least April 16.

Molting period. Molting seals were noticed between June 2 and 26, 1955, but no seals were examined after the latter date. During this period some seals that were examined were not molting.

Sinking period. Throughout the winter in north Baffin Island a few dead seals sank before their bodies could be recovered; but a considerable number sank during the summer. In September 1954 we lost 10 out of 36 seals that we shot. The salinity of the sea water at the surface in Arctic Bay on September 22 was 29.2 0/00 (Ellis, 1956) and the sinking was therefore not due to an appreciable lowering of the density of the sea water. The seals probably sink more often in summer because their own density is raised by a seasonal reduction in the amount of their blubber.

However, it should be noted here that in north Baffin Island some seals floated during the summer, whereas Steffanson (1922) reported that almost all seals in the western arctic region sank at that time of year. From Steffanson's descriptions of the extensive fresh-water layer that forms on the surface in the western arctic (but which does not develop to the same extent in the eastern arctic) it seems very likely that the lowered density of the surface water there increases the loss of seals through sinking.

Methods of seal hunting. In Admiralty Inlet it was possible to hunt seals through their breathing holes in the ice from November to April. During the dark months of November, December and January when the sun was absent, it was the only possible method of hunting. From February to June, seals were hunted at the floe edge and from April to July they were also hunted as they slept on the ice. After the ice broke in July, until it formed again in October, the seals were hunted in boats or from the shore.

HARP SEAL *Phoca groenlandica* Erxleben

1954. Herds were seen only on September 9 in Adam Sound and Admiralty Inlet.

1955. This species, which occurs in Eclipse Sound, had not been seen near Pond Inlet when I left the settlement there on August 5.

SQUARE-FLIPPER (= Bearded seal) *Erignathus barbatus* (Erxleben)

1954. A single square-flipper appeared amongst drifting ice floes near our ship on August 24 as we crossed the Queen Maud Gulf. On November 27 or 28 an Eskimo shot one through a breathing hole close to the floe edge in Admiralty Inlet.

1955. This species was abundant at the floe edge near Koubvigjuak amongst drifting ice when my Eskimo guide and I hunted there in February. A young specimen was shot as it lay on a drifting pan of ice on February 18; the temperature was then about —30°F. A single square-flipper was seen on May 27 on the ice at the floe edge near Button Point.

WALRUS *Odobenus rosmarus* (L.)

1955. Walrus and their freshly formed breathing holes were also abundant amongst drifting ice at the floe edge near Koubvigjuak in February. Walrus appeared occasionally at the floe edges in Admiralty Inlet and near Button Point in April and May. The Eskimo and white residents reported that the walrus go ashore on the Wollaston Islands in Navy Board Inlet — although not to breed, as stated by Miller (1955). These islands are small, low-lying and covered with gravel, but generally drop steeply into the water. The walrus are believed to go ashore along the south sides of the two main islands where the gradient of the shore is not so steep as elsewhere.

KILLER WHALE *Grampus orca* (L.)

1955. The Eskimo stated that killer whales were in Eclipse Sound during the night of July 26-27 because the jar seals were then concentrated in shallow water close to shore.

WHITE WHALE *Delphinapterus leucas* (Pallas)

1955. White whales were first seen on April 24 at the floe edge in Navy Board Inlet. They were accompanied by narwhals *Monodon monoceros* and appeared to be migrating west. On June 7 a school of at least 20 white whales appeared in a small lead of water amongst densely packed ice at the floe edge near Button Point.

NARWHAL *Monodon monoceros* L.

1955. Narwhals were first seen on April 24 in company with white whales at the floe edge in Navy Board Inlet. One was shot by the Eskimo on May 12 at the floe by Button Point and my guide and I saw another there on May 26. Narwhals penetrated Eclipse Sound on July 25, six days after the ice broke and began to move. They were preceded and accompanied by hundreds of fulmars *Fulmarus glacialis*. Several small schools passed the settlement of Pond Inlet traveling west on July 25 and 26. Only calves and cows were taken during these two days and the bulls either passed after I left the region on August 5 or were so far offshore that they were not hunted.

HARE *Lepus arcticus* Ross

1954. Hares were common near Arctic Bay during the fall and winter.

1955. Several tracks were seen in January, inland south of Moffet Inlet and between Bell Bay and Gifford Fiord. Individuals were seen near Gifford Fiord on March 11 and on April 23 between Admiralty Inlet and Navy Board Inlet.

GROUND SQUIRREL *Citellus parryii* (Richardson)

1954. Ground squirrels were common around Coppermine from May 10 and were most abundant on the islands of the river delta and along the lower terraces of the river. They were also abundant at Bathurst Inlet. A single ground squirrel was seen near Spence Bay on August 31 but from the lack of tracks around the settlement the species was obviously not common there.

LEMMING *Dicrostonyx groenlandicus* (Traill)

1954. I saw this species occasionally at Coppermine and Arctic Bay. At the latter settlement tracks of either *D. groenlandicus* or *Lemmus trimucronatus* (Richardson) were frequent.

REDBACK MOUSE *Clethrionomys rutilis* Pallas

1954. Two redback mice were trapped in the warehouse of the Hudson's Bay Company at Coppermine on May 11.

TUNDRA MOUSE *Microtus oeconomus* Pallas

1954. These mice were common on wet low ground within the settlement at Coppermine.

MUSKRAT *Ondatra zibethica* (L.)

1954. A colony of muskrat was spread over two adjoining lakes about six miles southwest of Coppermine. Four animals were seen there on June 18. A single line of fresh tracks was seen along the shore about six miles north of the colony on July 16. The Eskimo reported that there were a few other colonies near Coppermine.

CARIBOU *Rangifer arcticus* (Richardson)

1954. Caribou were very rare during the summer within ten miles of Coppermine and I saw only a single line of fresh tracks on July 19 by the river.

1955. The fresh tracks of six caribou were seen in the valley of the Gifford River on March 14. This considerably surprised my guide who maintained that the caribou usually spent the winter farther east although they were common by the Gifford River in summer.

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THE SPHAERIIDAE OF LAKE NIPIGON

H. B. HERRINGTON
Keene, Ontario

Received for publication April 9, 1956

This paper is a study of material of *Pisidium* and *Sphaerium,* family Sphaeriidiae or fingernail clams (Mollusca : Pelecypoda), collected in Lake Nipigon, Ontario, by F. B. Adamstone during the summers of 1921-1923. At that time Adamstone and his colleagues made a study of the kinds of life in Lake Nipigon. Samples of the Sphaeriidae collected were sent to Victor Sterki for determination and his findings were included in the reports on other subjets. No systematic study, however, has been made of the sphaeriids as a whole. After some years these specimens were sent to me by the Royal Ontario Museum of Zoology and Palaeontology, Toronto, for determination. I appreciate having them for study and wish to thank the Museum for this privilege.

Adamstone (1924) says that "Lake Nipigon is the largest of the inland lakes of Ontario and covers an area of approximately 1,750 square miles. It is situated about fifty miles north of Lake Superior into which it empties through the Nipigon River. The district surrounding the lake is well-wooded, rugged, hilly country, typically Archaean, and composed largely of igneous diabasic rock which bears much evidence of past glacial action. The lake itself existed formerly as a bay of the ancient Lake Algonquin from which it was separated at the close of the last ice age..."

The lake, 813 feet above Lake Superior, is about 60 miles from north to south and 45 miles from east to west. The shore line is about 850 miles in length but its extent is greatly increased by numerous groups of islands. These islands are arranged from north to south and somewhat divide the lake into east and west.

I find myself in essential agreement with Sterki's determinations, except that (a) I do not know what he means by *Pisidium clavetum* Sterki. Apparently it is only a manuscript name. As *P. conventus* Clessin is the dominant species in this fauna, and Sterki makes no mention of it, it may be the species he had in mind. (b) A number of the names he uses are only synonyms. (c) As Sterki mentions the well-known species *Sphaerium rhomboideum* (Say), of which I could find no specimens (except from a near-by small lake), and as he reports *P. idahoense* Roper and the form *indianense* Sterki of which I found only one specimen, I conclude that a few specimens were kept out of the collection.

There are some factors that contribute toward, and others against, the abundance of sphaeriids in this lake. Among the unfavorable constituents are the following: the long winters; the great size of the lake, a factor that permits much scouring of large waves by high winds along open stretches of rocky or sandy shores; the many rivers that run into the lake, bring in large quantities of sand, and help to build up sandy shores that are uninhabitable for little clams.

Some of the favorable factors are: the mouths of streams and rivers; and the many indentations of the shore line of the islands creating protected bays where fine sand, mud, and ooze collect. On such bottoms vegetation thrives, and among the roots of this vegetation live the shallow-water sphaeriids.

In collecting specimens a small Ekman bottom sampler, having an area of 81 square inches, was lowered. When it reached bottom a messenger was dropped down the cable, closing the jaws. A drag dredge was also used on a few occasions.

The specimens recovered may be divided as follows: (a) from the stomach of fish, (b) dredged, with no record of depth kept, and (c) dredged with a record of depth kept.

The specimens secured by (a) are *Pisidium casertanum* (116 166/2), *P. compressum* (3 4/2), *P. conventus* (240 347/2), *P. fallax* (2 2/2), *P. ferrugineum* (59 264/2), *P. lilljeborgi* (74 394/2), *P. lilljeborgi cristatum* (2 1/2), *P. nitidum* (22 2/2), *P. nitidum pauperculum* (84 69/2), *P. subtruncatum* (1), *P. variabile* (4/2), *P. walkeri* (1), *Sphaerium striatinum* (12 5/2).

Specimens secured by (b): *P. casertanum* (1), *P. compressum* (4 4/2), *P. conventus* (1 24/2), *P. ferrugineum* (1), *P. nitidum* (2), *P. nitidum pauperculum* (26 12/2), *P. obtusale* (1), *P. variabile* (20 1/2), *S. securis* (1), *S. striatinum* (3 2/2), *S. sulcatum* (2 5/2). With the exception of the above this paper deals only with (c).

TABLE 1. Numbers of specimens of *Pisidium* and *Sphaerium* found at various depths

	DEPTH RANGE (FT.)											
Species	0-10		10-30		30-100		100-160		Over 160		Total	
P. casertanum (Poli)	64	10/2*	8	4/2	4	5/2		1/2			76	20/2
" *compressum* Prime	23	43/2	6	8/2							29	51/2
" *conventus* Clessin	24	4/2	47	10/2	60	559/2	1908	24145/2	6	132/2	2045	24850/2
" *fallax* Sterki	4	4/2									4	4/2
" *ferrugineum* Prime	34	1/2	34	3/2	3	1/2					71	5/2
" *idahoense* Roper	1										1	
" *lilljeborgi* Clessin	56	10/2	25	10/2	25	40/2		278/2		1/2	106	339/2
" " *cristatum* Sterki	3	1/2	10								13	1/2
" *nitidum* Jenyns	10				4	1/2					14	1/2
" " *pauperculum* Sterki	53	26/2	23	7/2	2	5/2					78	38/2
" *obtusale ventricosum* Pr.	5										5	
" *punctifera* Guppy	11	1/2			1						12	1/2
" *subtruncatum* Malm, a f.	10							17/2			10	17/2
" *variabile* Prime	24	6/2	5	4/2	2	1/2		1/2			31	12/2
" *walkeri* Sterki	9				1			167/2			10	167/2
S. lacustre (Müller)	5										5	
" *striatinum* (Lamarck)	5	7/2	31	24/2	4	5/2					40	36/2
" *sulcatum* (Lamarck)	3	1/2									3	1/2
" *tenue* Prime	2		4	1/2	2		1	1/2			9	2/2
Total	346	114/2	193	71/2	108	617/2	1909	24610/2	6	133/2	2562	25545/2

* Whole clams are shown by whole numbers, single valves by fractions

Whole specimens (valves in attached pairs) are recorded by whole numbers, single valves by fractions; for example, 5 4/2 means 5 complete specimens and 4 single valves.

Total counts were made on all dredge hauls except for one at 150 ft. in which *P. conventus* was very numerous (Table 1). In the exceptional case a sample was counted and the total was estimated therefrom. When most of the hinge was present the piece was counted as a valve. Small pieces were not counted. Specimens alive when collected give more accurate information than empty shells. Specimens may be carried by bottom currents beyond the depth at which the specimen can live. From the present condition of these shells it appears that most specimens were empty when collected. The great number collected at 150 ft. leads me to think that some of the trials with the drag dredge were made at that depth.

The species which have been for a number of years regarded as a separate genus and given the name *Musculium* I regard as one of the groups of *Sphaerium*.

At a depth greater than 100 feet whole specimens were found only of *P. conventus* and *S. tenue*. One specimen of *P. conventus* was brought up from a depth of 321 ft., but this is not as great a depth as in Great Slave Lake, North West Territories, where a live specimen was collected from a depth of 718 ft. (Herrington, 1950). Of the others, specimens of *P. lilljeborgi* were recovered at intervals down to 96 ft., *P. casertanum*, one at 51 ft. and one at 93 ft., and two specimens of *S. striatinum* at 68 ft. No whole specimens of any other species were recovered from depths greater than 54 ft.

Sphaerium striatinum is the high form, and S. *sulcatum* is the high form *crassum* Sterki. *P. obtusale* is the form *ventricosum* Prime, found only in lakes. *P. subtruncatum* is the western form frequently met with in Western Canada east of the Rocky Mountains. The specimens have some resemblance to *P. lilljeborgi* and to *P. walkeri*. However, they appear to intergrade with *subtruncatum* and to be a form of that species. There is also a short form of *P. casertanum* in this lake (and in some other lakes) that somewhat ressembles this western *subtruncatum*.

The following species collected in Lake Nipigon are circumpolar: *Pisidium casertanum, P. conventus, P. ferrugineum, P. lilljeborgi, P. nitidum, P. obtusale, P. punctifera, P. subtruncatum, Sphaerium lascustre,* and *S. tenue*.

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Elsie Margaret Groves

ELSIE MARGARET GROVES

1897 — 1956

In the death on December 1, 1956, of Mrs. J. Walton Groves, the Ottawa Field-Naturalists' Club lost an enthusiastic and valued member. Keenly interested in all Club activities, she served for a number of years as a member of Council and as the editor of the Newsletter. She was an active supporter of both the Bird Group and the Fern Group.

Mrs. Groves was born in Sunderland, England, on August 26, 1897, the daughter of the late William H. Reah and Alice Charlton. She was educated in Sunderland where she attended the Venerable Bede College and the extension of Durham University in Sunderland. Toward the close of the first World War she served with the Women's Land Army in England.

She came to Canada in 1922, resided briefly in Toronto and subsequently spent more than ten years in the Temagami district, as governess, manager of a tourist resort on Bear Island, and as owner of her own business. During these years she was a keen observer of Indian life and customs, learned the Ojibway language and spent much of her spare time in teaching the Indian children. When the noted geneticist, Dr. R. Ruggles Gates, visited Temagami he found her knowledge of the Indians of that area so exhaustive that he published a paper based largely on her notes and observations (A study of Amerindian crosses in Canada. J. R. anthrop. Inst. 58: 511-532. 1928).

One of the many students of botany who collected in the preserve during the summer months was Walton Groves, whom she married in Toronto in March 1936. Later that year she moved to Ottawa where Dr. Groves had accepted an appointment as Mycologist with the Division of Botany of the Department of Agriculture.

A lover of the out-of-doors and all aspects of natural history, Mrs. Groves easily became interested in the study of botany and assisted her husband in the collecting of fungi in the field. She accompanied Dr. Groves to the International Microbiological Congress in Copenhagen in 1947, to the International Botanical Congress held in Stockholm in 1950 and in Paris in 1954, and on visits to herbaria in Europe and the United States. Because of her knowledge of mushrooms and the larger fungi she was able, on each of these trips, to help in taking notes on the specimens examined. Even more important, her knowledge of, and interest in, people proved of invaluable assistance to her husband in making contacts with other botanists.

Mrs. Groves made many valuable contributions to the cause of natural history. She studied ferns and had an extensive collection of those of the Ottawa District. The more interesting specimens have now been deposited in the herbarium of the Botany and Plant Pathology Division, Science Service, Department of Agriculture.

An enthusiastic bird watcher, she regularly took part in the Christmas Bird Census, and contributed records of Ottawa District birds. She was a member of the Federation of Ontario Naturalists and, for some time, a member of the American Association for the Advancement of Science.

Second only to nature was Mrs. Groves' love of music. She was active in a number of productions of the Orpheus Operatic Society, sang with the Ottawa Choral Union, and was for several years a member of St. James' United Church Choir.

Mrs. Groves took a lively interest in all about her. Of a warm and generous personality, she was always ready to offer friendship. She will be remembered by many as a gracious hostess and a sincere and understanding friend.

ANNE BANNING

WOLFFIA IN CANADA[1]

WILLIAM G. DORE
Science Service Building, Ottawa, Ontario

Received for publication, April 11, 1956.

The water-meals of the genus *Wolffia*, the smallest of all flowering plants in the world, are of relatively restricted occurrence in Canada and consequently, when they are encountered in the field, they become a matter of considerable interest. In recent years, *Wolffia* has been found in abundance at a few sites near Ottawa and so it has been possible to observe the plants more closely in the living state (Fig. 1). There has been difficulty, however, in identifying them to species by the use of keys and descriptions in current manuals, and this state has suggested the present review of their diagnostic characters and geographic distribution.

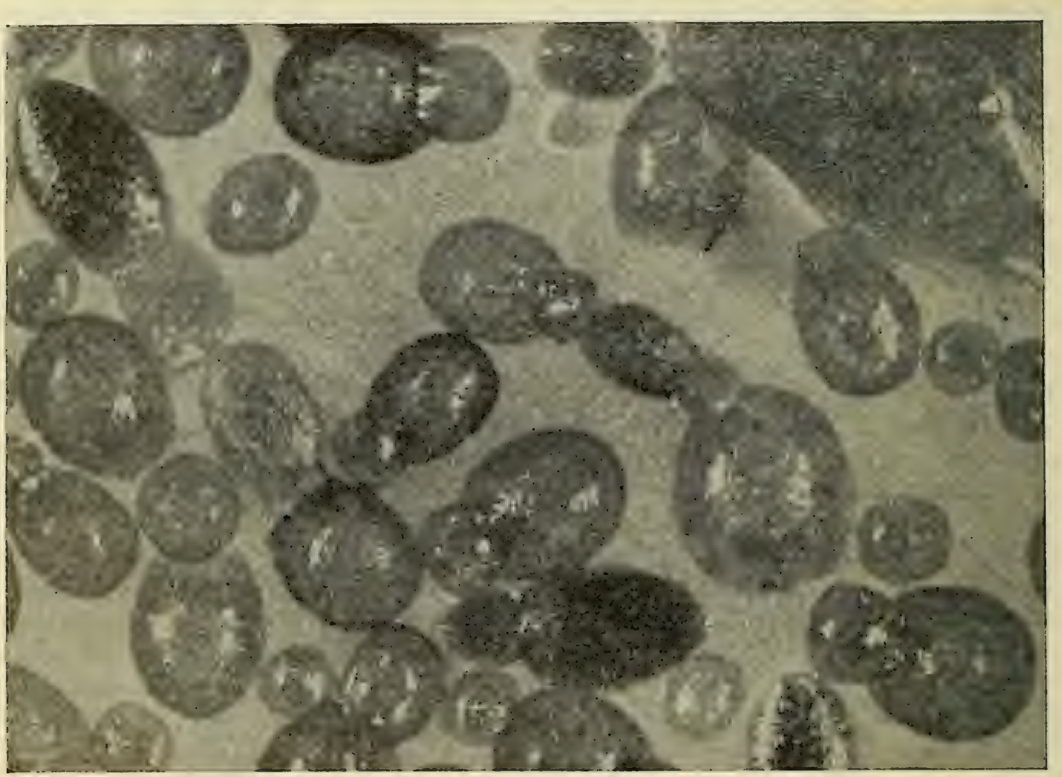

Fig. 1. Two species of *Wolffia*, enlarged about 30 times, floating on water from a pond at Ottawa. The pointed plant in the upper left is *W. punctata* and the rounded plant in lower right of the photograph is *W. columbiana*; other individuals in various stages of growth and fragmentation are seen. A portion of a frond of *Lemna minor* appears in the upper right.

Two of the three species of *Wolffia* recognized for North America, *W. punctata* Grisebach and *W. columbiana* Karsten, are present in southern Ontario and adjacent southwestern Quebec. Although about the same in size (1 to 2 mm), the two species are decidedly different in shape and structure of the plant body. In dry specimens, however, the characters are scarcely discernible and one has to rely on the presence or absence of 'dots,' or punctae. In his classical revision of the North American Lemnaceae, C. H. Thompson (1898) stated that *W. punctata* was "profusely punctate throughout with brown epidermal cells," but in other works we find either the "upper surface brown-dotted" (Muenscher 1944) or there is no clear statement of the disposition of the dots. The line illustrations given in manuals are often small and obscure, and consequently it is difficult to distinguish between punctae, stomata, and stipple marks. *W. columbiana* is completely lacking in brown dots.

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[1] Contribution No. 1578 from the Botany and Plant Pathology Division, Science Service, Canada Department of Agriculture, Ottawa, Ontario.

The dotted character of *W. punctata* (which gives it its name) is clearly detected under slight magnification (×10) when dry material is examined, especially if the specimens have first been soaked up and 'cleared' with acid. However, when living plants are observed no dots can be seen! At least, this was the experience with the fresh plants examined at Ottawa. It seems that the all-important brown dots are a feature which develops on slow drying of plants and hence a characteristic only of herbarium specimens. This fact may explain some of the difficulties encountered in identification, as well as the discrepancies in manual descriptions and illustrations.

When living plants are preserved in a killing solution such as Formalin-Acetic-Alcohol, the plants lose much of their green color and become quite transparent. The 'dots' in *W. punctata* may then become just barely visible. If such specimens are then stained with safranin and fast green, the 'dots' become very distinct and their nature can be understood more clearly. They are then seen to be actual cells of the plant body — not just specks of dirt or debris adhering to the surface — and, to prevent confusion, they should be referred to, more properly, as 'punctae.' They are restricted in their location to the epidermis or, especially on the lower portions of the plant, to the layer of cells immediately beneath the epidermis. The pigmented material they contain is distributed rather uniformly throughout the cell, sometimes in the form of amorphous globules. The outline of the punctae therefore is somewhat angular and variable, conforming to the shape of the particular cell. In size, the punctae are as uniform as the cells themselves, and for the same reason. They are distributed rather regularly over all surfaces of the plant body, spaced at about 2 to 4 cell-widths, and averaging in number between 75 and 150 per frond. In young bud-plants where the cells are smaller, the punctae accordingly are closer together. On the upper surface of the frond where the stomata are located, a puncta is usually adjacent to one of the guard cells, although all of them are not so restricted. Since their distribution follows an organized pattern, it is likely that they are specialized cells set aside for some particular function, the nature of which is not known.

The stomata can generally be seen with a hand lens because of the way the light is reflected from them (see Fig. 1). They can also be located by using iodine to color the starch in the guard cells.

The following contrasting characters are grouped according to the material available and the technique for examination.

CHARACTERISTICS OF THE TWO CANADIAN SPECIES OF *WOLFFIA*

W. columbiana Karst.	**W. punctata Griseb.**
Field characters shown by fresh plants as visible to the naked eye:	
Plants pale green throughout, essentially globular in form; in crowded populations many plants forced to lie beneath the surface of the water.	Plants bright green above, pale green below, two to four times longer than broad, pointed at both ends; plants generally floating in single layer on surface of water, often in short chains.
Fresh plants observed under low-power magnification (×10)—See Fig. 2:	
Fronds globular or ovate in top and side view, uniformly light green and translucent; plants floating low in the water with only a small circular portion of the surface in contact with the air; stomata not visible.	Fronds ovate-elliptical and somewhat pointed at one end in surface view, almost flat or slightly concave on the top and deeply gibbous below in side view; upper portion deep green and opaque, lower portion light green and translucent; plants floating with essentially all of the upper surface exposed, the surface shiny and reflecting light, allowing the position of the numerous stomata to be barely visible.

Fresh plants mounted in water under a cover glass, observed under dissecting or compound microscope (×30 to ×60):

Fronds globular or ovate in outline; the exposed surface (constituting an arc of about ⅛ of the circumference) essentially plain or usually with 2 or 3 low elevations (constituting, when viewed from the side, both rims of the circular flange and sometimes a single bulging cell in the middle); stomata few (3 to 5): epidermal cells conspicuous as a reticulum due to the chloroplasts lining their side walls, about .04 to .06 mm across; chloroplasts also present in the cytoplasm along outer portion of wall.	Fronds ovate-elliptical and somewhat pointed at one end in surface view, essentially hemispheric in side view; the surface exposed to the air essentially flat or slightly concave longitudinally, slightly convex latitudinally, the surface shiny and 'water-proof'; stomata numerous (25 to 50), all oriented longitudinally; epidermal cells not conspicuous and appearing clear when viewed tangentially (because chloroplasts restricted to the inward wall); epidermal cells .02 to .03 mm across.

Plants stored in liquid preservative:

Most features mentioned above, but fronds uniformly clear and almost transparent; punctae absent.	Most features mentioned above, but upper portion of fronds white and opaque, lower portion clear and almost transparent; punctae sometimes visible as pale amber-colored cells.

Dry specimens observed under low-power magnification (×10):

Plants completely collapsed and shriveled, thin, somewhat translucent.	Mature fronds retaining somewhat their original form, but smaller and opaque; immature fronds shriveled.

Dry specimens, boiled in acid solution and examined under low-power magnification (×10):

Plants collapsed, often conical in shape, transparent; epidermal cells usually conspicuous (because of lining of chloroplasts); punctae lacking.	Plants elongate, firm, opaque; epidermal cells not conspicuous; punctae present throughout fronds, conspicuous.

OCCURRENCE AND DISTRIBUTION

Relatively few collections of *Wolffia* are available on which to base our information on habitat and range. It has been thought that *Wolffia* may actually be quite prevalent in nature, but that the plants pass unnoticed on account of their minute size. Indeed, it is only in late summer after the plants have had a full season to multiply that they become conspicuous en masse—and at that time most botanists have curtailed their field activity! Practically all the Canadian collections have been made between the middle of September and the middle of November. On the other hand, about ten times as many collections have been made of each of the three species of *Lemna* from aquatic habitats within the general range of *Wolffia*, and this would suggest that *Wolffia* is truly more rare and sporadic.

In late summer *Wolffia* tends to accumulate as a continuous and often thick layer on the surface of the water in ponds and marshes, particularly on the windward side where they have drifted in. Vast numbers

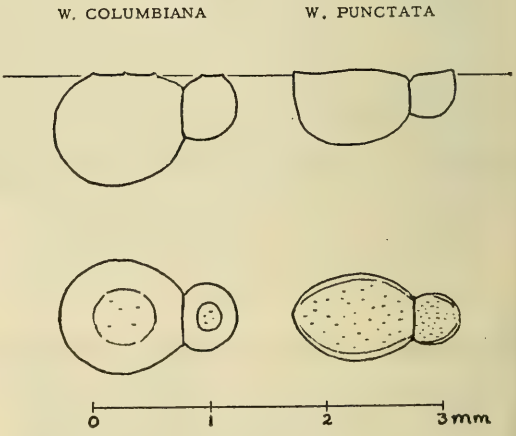

Fig. 2. Diagrams of *Wolffia columbiana* (left) and *W. punctata* (right) depicted in side-view (upper) and top-view (lower) to show comparative shape, location of stomata, and relation to water surface. The punctae usually described as diagnostic for *W. punctata* are not visible in vigorous plants such as those from which the drawings were made.

can be scooped up in the hand or in a strainer, and it is then that they can be readily distinguished by their characteristic granular nature from other forms of green aquatic growths. Since the plants tend to adhere to the hand or to any other structure withdrawn from the water (because of surface tension rather than to any adhesive or clinging device), it is easy to understand how they could be carried from pond to pond, possibly to considerable distance overland, by water birds or wading animals. Despite their small size, the plants do not seem to dry out rapidly, at least not as rapidly as do most aquatic plants. It is suspected, too, that man may play a part, unintentionally, in the transport of *Wolffia* when he moves from place to place with his fishing gear and boats, or when he transfers water lilies and other aquatic plants to aquaria and garden pools. Since the two species often occur in mixed populations some such mass means of dispersal seems likely. No flowers or seeds have been noticed on Canadian material.

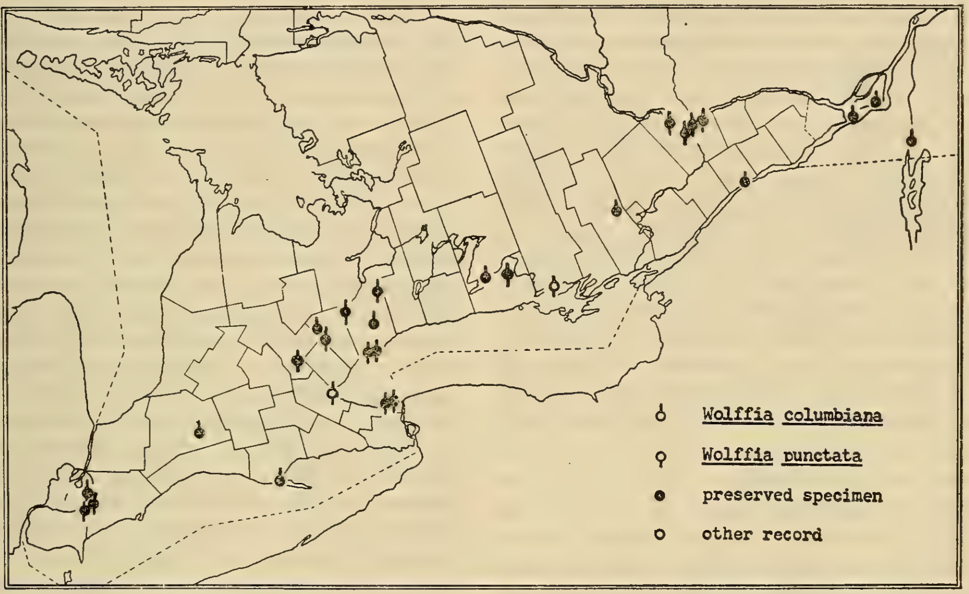

Fig. 3. Map of southern Ontario and adjoining Quebec indicating stations where the two species of *Wolffia* have been collected or reported in Canada.

The geographic distribution of the two species of *Wolffia* in Canada as known from herbarium specimens and records is shown in the map (Fig. 3). The specimens examined are preserved in the following herbaria: Department of Agriculture, Ottawa; National Museum of Canada, Ottawa; University of Toronto, Toronto; Botanical Institute, University of Montreal, Montreal; McMaster University, Hamilton.

On the map the two species, *W. columbiana* and *W. punctata*, are plotted together because they appear as mixtures in most collections and their ranges, in general, are similar. It is shown that *Wolffia* occurs within a relatively narrow strip across southern Ontario and adjoining Quebec. This represents just the northern fringe of the broader distribution in North America which takes in most of eastern United States.

It is difficult, at the present time, to decide whether or not the two species of *Wolffia* were original elements of our flora. The early records (Ottawa 1882, Belleville 1888, Hamilton 1888, Niagara-on-the-Lake 1889, London South 1891, Toronto 1894) all are from sites where there was substantial settlement in the 1880's, four of them situated on Lake Ontario as important centers of lake shipping. It is therefore conceivable that the plants could be carried along by the boats. On the other hand, the records, although not very early, date from the pioneer stage in botanical collecting in Upper Canada and it is quite possible that both species were originally native, at least to the Canadian shores of Lake Ontario. At any rate, a gradual spread to inland points north of the lower Great Lakes is indicated, a spread which took place since settlement and is still going on. Judging from the vigor of the plants, the ultimate limit to which they will spread has apparently not yet been reached.

The group of recent collections from the Ottawa area (MacKay Lake 1930, Rideau Canal 1947, Constance Lake 1952, Woodroffe 1953 and 1955), all showing mixture of the two species, needs special comment. At first it was thought that these localized populations had become established as the result of accidental introduction, perhaps as stray plants adhering to the roots of ornamental aquatic plants brought in from nurseries to the south. The specimens from the Rideau Canal at least were collected near Brown's Inlet where exotic water lilies had been grown for some years. It was later realized, however, that James Fletcher (1882), in making additions to his early Flora Ottawaensis, had already made the record, "*Wolffia Braziliensis* Weddell," for the Ottawa District, the first for any species of *Wolffia* in Canada. The name he used was that of the fifth edition of Gray's *Manual*, but the plant is now known as *W. punctata*. A few years later, Macoun in his *Catalogue of Canadian Plants* (1888, and additions of 1890) listed the several records then known to him but neglected to mention Fletcher's Ottawa record. We do not think this was a mere oversight because he honored most of Fletcher's other records; apparently he left it out of his *Catalogue* intentionally, and for some reason now unknown. He may have considered Fletcher's record unreliable, because there was no specimen provided to support it. Or it may have seemed too unusual to be creditable. Although it was some 50 years before *Wolffia* was to be definitely collected in the Ottawa District, we have little reason to doubt that Fletcher actually did find a species of *Wolffia*, but we do not know whether he found a mixture of two species then, in the way that they are now found. It is interesting to note that in his second edition of Flora Ottawaensis (Fletcher 1893), he records *Wolffia* again, this time as *W. Columbiana,* stating, "abundant in the St. Louis Dam ... and floating just beneath the surface film of the water. Fronds pale green, loosely cellular, almost globular, about 1/40 of an inch in diameter with a circular bordered opening beneath, no rootlets". This description allows us to know that this time he actually saw the plant known as *W. columbiana*; but now he fails to repeat *W. Braziliensis* (*W. punctata*) claimed in his first edition! Likely there was a mixed population in the Rideau Canal and he recognized a different species each time. The plants could have been carried through the Canal by the boats from Lake Ontario; both species are recorded from the Bay of Quinte by Macoun in his Catalogue dated 1888.

When a collection is pure for one species, that species is nearly always *W. columbiana.* Six collections which appear to be pure for it form a block in the eastern countries of Ontario and southwestern Quebec. All have been made relatively recently: Keene 1952, Sharbot Lake 1952, Morrisburg 1953, Ile Perrot 1949, Verdun 1939, Ile-aux-Noix 1952. All are at points which might be popular for fishing or duckhunting and, consequently the possibility of the plants having been transported by sportsmen is great. The occurrence at Keene is in Indian River at a point where commerce in Wild Rice *Zizania* has been conducted for many years; that at Ile-aux-Noix in Richelieu River is in the moat surrounding historic Fort Lennox. The record for Verdun, published as the first discovery of *W. punctata* in Quebec (Wynne-Edwards 1941) was collected in a small pond in waste ground at Crawford Park. The material of this latter collection preserved at the National Herbarium, although meager and encrusted with the dry preservative, however, appears on examination to consist only of *W. columbiana*.

The third North American species, *W. papulifera* C. H. Thompson, continues to be reported in the United States from new sites at some distances from the original ones in Missouri; in Ohio, Kentucky, West Virginia, Kansas and Florida. The closest site yet recorded to Ontario is that in the Holden Arboretum located along the Lake Erie shore east of Cleveland, Ohio (Walters 1950). Although difficult to recognize from *W. punctata* in the dry state, *W. papulifera* has not been detected so far among the plants in Canadian collections. It should, however, be searched for in waters adjoining Lake Erie.

During the review of specimens and records, no basis has been found for the range of *Wolffiella floridana* into Ontario (Hicks 1937).

NOTE ON PREPARATION OF SPECIMENS

The collecting and preserving of *Wolffia* specimens is often a perplexing matter to those familiar with the techniques of pressing and mounting the usual plant specimens. When only a few individuals of *Wolffia* are available, they become almost invisible when dried on the pressing sheet; they do not adhere to the paper and are apt to become lost in subsequent handling. When available in quantity and dried en masse there is still the problem of transferring them to packets and preventing their 'dusting out' and contaminating other collections. If, however, the fresh plants can be spread in a uniform layer between two sheets of cellophane (or inside a small cellophane envelope) before being placed in the press, they will tend to adhere to the cellophane and not shrivel so much on drying, and at the same time they are made ready for future handling and for filing in a packet on the herbarium sheet. Dried plants at best are quite shriveled and are often so distorted that it is usually impossible to determine their natural shape or even to tell which surface was uppermost. To some extent, dry specimens can be softened and relaxed for examination by boiling them in water to which a wetting agent such as Aerosol or Dreft has been added, but they do not seem to respond to this treatment as readily as do the dry tissues of other plant specimens. Boiling in acid, in addition, clears the cells and allows the plants to be flattened out for microscopic examination under a cover slide.

Plants put up in a fluid preservative such as Formalin-Aceto-Alcohol are much better for identification since their shape and structure is maintained, although their green color and buoyancy may be sacrificed. Corked or capped vials, however, have not always been satisfactory for long-term storage, especially if filed in a horizontal position in herbarium folders. If the preserved material can be placed in a glass ampoule previously heated and flattened smoothly, and then sealed off at the tip, a mount for perpetual storage will result. The flattened ampoule may then be fitted in a padded sleeve (made from a pressing felt) and glued to the herbarium sheet without danger of breakage or leakage. For direct microscopic examination little optical distortion from the glass will result if the ampoule has been molded smoothly and filled so that the meniscus lies in its neck. A small label with identifying number written in India ink should be placed inside the ampoule.

INTERNAL STRUCTURE AND MULTIPLICATION

I am indebted to my colleague, Raymond J. Moore, for contributing the following information on chromosome number and cellular structure.

Lawalrée (1943) has described in detail the microscopic anatomy and method of vegetative budding in *Wolffia arrhiza* (L.) Wimm., a European species, and has reported that the somatic chromosome number is *ca.* 40.

Specimens of *W. punctata* (Dore & Dore 16388, October 10 1955, Woodroffe, Ont.) were fixed in weak chromacetic fixative, embedded in paraffin and sectioned in the usual manner. The sections were stained in safranin and fast green.

Wolffia punctata appears to be similar in size and in internal anatomy and in method of vegetative budding to *W. arrhiza*. The chromosome number also was found to be the same, $2n = ca. 40$ (Fig. 4).

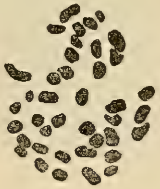

Fig. 4. Somatic chromosomes, $2n = ca.$ 40, of *Wolffia punctata* (×3000). (R. J. Moore)

A photomicrograph of a median longitudinal section of a plant of *W. punctata* is shown in Fig. 5. A mature frond with smaller 'bud' fronds developing from it is seen in this photograph. In internal structure the adult frond resembles the leaf of an angiosperm. An epidermis, one cell thick, forms the upper (aerial) surface, and in it can be seen several latent punctae, made dark by the safranin. Beneath this is an area of columnar chloroplast-bearing cells analogous to the palisade layer of the angiosperm leaf. Stomata in the epidermis open into intercellular air spaces in this zone. Beneath this dense area the cells become gradually larger and less regular in shape and lack chloroplasts.

The mature plant multiplies by producing a series of buds at the bottom of a pouch at the apical extremity of its frond (at right in Fig. 5). As described by Lawalrée, each bud arises from a single cell of the dermatogen and soon develops into an elongated protuberance. Several vegetative generations of buds may be found in any free-floating plant and each generation may be represented by more than one bud. The sequence of budding may be briefly described from Fig. 5. The adult frond is indicated at I, and successive vegetative generations are indicated at II and III. The buds within each generation are marked by the letters a, b, c, etc. in order of their development. The largest bud present in this case is labelled IIc. This bud will shortly be liberated by the rupture of the stalk at its lower left corner. The ruptured stalks of two earlier buds of the same generation, IIa and IIb, are visible. A later bud of this generation is marked IId. Each bud of this generation is capable of producing buds of the third generation, and one borne by bud IIc is indicated as IIIc. A very early third generation bud can be seen on bud IId on its lower left side.

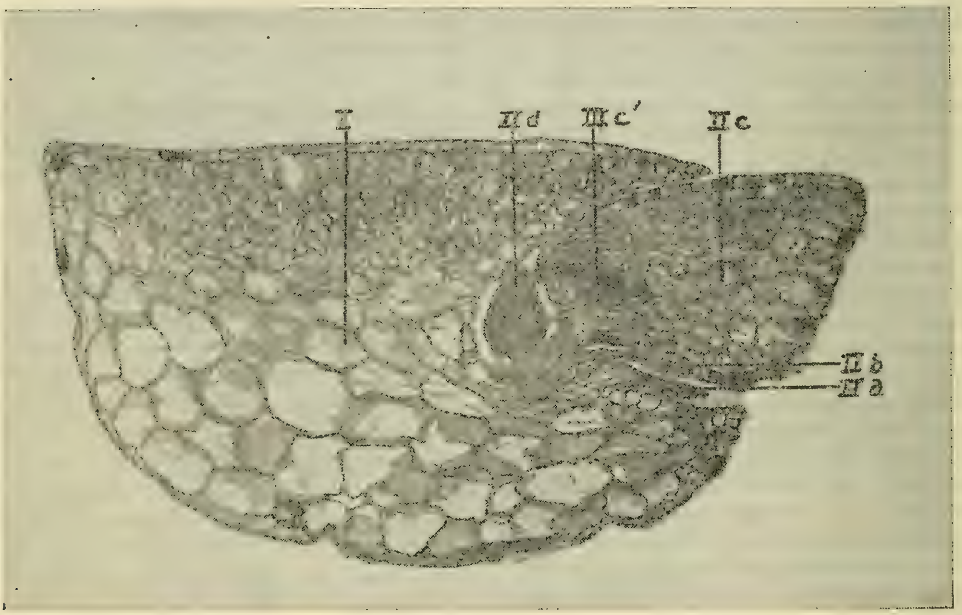

Fig. 5. Photomicrograph of longitudinal section of plant of *Wolffia punctata* (×85). For description see text. (R. J. Moore)

It will be noticed that bud IIc, the most mature bud, already shows internal structure well on its way to the differentiation found in the adult. The top-to-bottom differentiation of its tissue is clearly visible. Presumably this differentiation is influenced by gravity and all buds show the same polarity with respect to this differentiation. On the contrary, successive generations show reversed polarity in the matter of apical differentiation. The apex of bud IIc is opposite the apex of its parent, I. The reason for this is unknown, but can give rise to some interesting speculation.

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CHRISTMAS BIRD CENSUS — 1956

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Regional groups are invited to contribute to this annual report. Forms for this purpose should be secured from and returned by 15 January to the associate editor, W. Earl Godfrey, National Museum of Canada, Ottawa, Ontario.

* * *

St. John's, Nfld. (City and two miles of coastline nearby). — Dec. 26, 1956, 9 a.m. to 4. p.m.; temp. 32° to 26°; wind W., 25 m.p.h. 9 observers in 6 parties. Total party hours, 14 (9 on foot, 5 by car); total party miles, 61 (9 on foot, 52 by car).

Old-squaw, 15; Common Eider, 300; Sharp-shinned Hawk, 2; Glaucous Gull, 15; Iceland Gull, 55; Great Black-backed Gull, 94; Herring Gull, 627; European Black-headed Gull, 2; Dovekie, 11; Black Guillemot, 6; Yellow-shafted Flicker, 2; Common Raven, 6; Am. Crow, 22; Black-capped Chickadee, 37; Brown-headed Chickadee, 8; Brown Creeper, 15; Am. Robin, 90; Golden-crowned Kinglet, 34; Northern Shrike, 2; Common Starling, 847; House Sparrow, 427; Purple Finch, 6; Pine Grosbeak, 23; Red Crossbill, 11; Slate-colored Junco, 18; Snow Bunting, 5. Total, 26 species; 2,680 individuals.

—John Macgillivray, Darroch Macgillivray, Leslie M. Tuck (compiler), Douglas H. Pimlott, Philip Rendell, David Rendell, H.H. Winter, Thomas Bergerud, Winona Bergerud.

West Middle Sable, N.S. (Sable River, West Middle Sable, Louis Head and beach, Little Harbour, Hemeon Head, Matthews Lake). — Dec. 22, 1956, 7.20 a.m. to 5.00 p.m.; mostly sunny; temp. 22° to 35°; wind N to SE, max. 15 m.p.h.; ground bare, some ponds and small lakes frozen over. 2 observers in 2 parties (1 stationary). Total party hours afield 9½ (6 on foot, 3½ by bicycle); total party miles, 25 (8 on foot, 17 by bicycle).

Common Loon, 1; Horned Grebe, 9; European Cormorant, 3; Canada Goose, 28; Mallard, 1; Black Duck, 261; Pintail, 2; Am. Golden-eye, 17; Buffle-head, 14; Common Eider, 2; Red-breasted Merganser, 4; Red-tailed Hawk, 1; Ruffed Grouse, 4; Great Black-backed Gull, 36; Herring Gull, 338; Black Guillemot, 1; Hairy Woodpecker, 1; Grey Jay, 5; Blue Jay, 5; Common Raven, 2; Am. Crow, 41; Brown-headed Chickadee, 7; Am. Robin, 1; Golden-crowned Kinglet, 7; Common Starling, 5; House Sparrow, 13; Baltimore Oriole, 2; Pine Grosbeak, 1; Ipswich Sparrow, 1; Slate-colored Junco, 6; Tree Sparrow, 8. Total, 31 species; 827 individuals.

—Harrison F. Lewis (compiler) and Laura N. Lewis.

Wolfville, N.S. (Base point, Acadia University. North to Delhaven; east to Hortonville; south to Gaspereau Valley; and west to New Minas). — Dec. 23, 1956, 8 a.m. to 4.15 p.m.; temp. 15° to 22°; wind easterly, moderate; Gaspereau River open; ponds frozen; overcast all day and ground partly bare and partly covered with crusted snow. 16 observers in 6 parties. Total party miles, 187 (36 on foot, 151 by car).

Black Duck, 482; Golden-eye (sp.) 22; Surf Scoter, 2; American Scoter, 30; American Merganser, 6; Sharp-shinned Hawk, 1; Red-tailed Hawk, 5; Am. Rough-legged Hawk, 4; Bald Eagle, 6; Marsh Hawk, 1; Ruffed Grouse, 5; European Partridge, 5; Common Pheasant, 43; Wilson's Snipe, 5 (R.W.T.); Great Black-backed Gull, 161; Herring Gull, 294; Great Horned Owl, 1; Yellow-shafted Flicker, 3; Hairy Woodpecker, 1; Downy Woodpecker, 2; Horned Lark, 13; Blue Jay, 14; Common Raven, 54; Am. Crow, 417; Black-capped Chickadee, 1; Brown-headed Chickadee, 12; Red-breasted Nuthatch, 2; Am. Robin, 20; Golden-crowned Kinglet, 28; Common Starling, 1,196; House Sparrow, 531; Cowbird, 3; Am. Goldfinch, 82; Savannah Sparrow, 10; Slate-colored Junco, 15; Tree Sparrow, 11; Song Sparrow, 5. Total, 37 species, 3,493 individuals.

—Joan Bromley, A.J. Erskine, Janet Erskine, J.S. Erskine, Rachel Erskine, Mary Forbes, Rupert Haley, Margaret Miller, Ralph Mosher, Eric Mullem, W.B. Schofield, Anne Sexton, Tommy Sheppard, Stephen Smith, Christopher Thurrott, R.W. Tufts (compiler).

Riverview Heights, N.B. (Base point Riverview Heights, Pine Glen Road, ¼ mile on Highway 14, Bulmer's Pond, and Interprovincial Home for Girls). — Dec. 31, 1956; windy; temp. -10° to 0°; streams and ponds frozen, Petitcodiac River choked with ice. 2 observers in 1 party. Total party hours, 2 (on foot).

Ducks (sp.), 4; Great Black-backed Gull, 2; Herring Gull, 20; Am. Crow, 32; Common Starling, 43; English Sparrow, 69. Total, 6 species; 170 individuals.

—Roger H. MacGregor, H. MacGregor, Brian Ellis.

Hudson Heights, Hudson, and Como, Que. (Same general area as in previous counts).—Dec. 30, 1956, 8 a.m. to 4 p.m.; clear; temp. -12° to -6°; wind NW, 20-30 m.p.h.; 6-8 in. snow on ground, all water frozen. 17 observers in 10 parties. Total party hours, 44½ (21 on foot, 4½ by car, 19 at feeders); total party miles, 109 (24 on foot, 85 by car).

Sparrow Hawk, 1; Ruffed Grouse, 4; Great Horned Owl, 1; Hairy Woodpecker, 29; Downy Woodpecker, 20; Blue Jay, 65; Black-capped Chickadee, 141; White-breasted Nuthatch, 29; Red-breasted Nuthatch, 4; Am. Robin, 1; Golden-crowned Kinglet, 2; Common Starling, 152; House Sparrow, 2; Pine Grosbeak, 9; Common Redpoll, 53; Am. Goldfinch, 4; Slate-colored Junco, 9; Tree Sparrow, 13; Fox Sparrow, 1. Total, 19 species; 541 individuals. Seen in area in count period: Arctic Three-toed Woodpecker, 1; Brown Creeper, 2; Cedar Waxwing, 6; Snow Bunting, 18.

—Mr. and Mrs. A.I. Bryan, Misses A. and M. Clarke, Mr. and Mrs. R. Cundill, Mrs. E. Connor, Mrs. G.A. Golden (compiler), C. Hope, B. Knox, A. Kelly, Mrs. D. Macaulay and D. Macaulay, Jr., R. MacDuff, H. Marpole, Mrs. D. Riley, Mrs. R.W. Wright.

Montreal, Que. (Mount Royal, Montreal West, Dorval, Saraguay, Ahuntsic, St. Helen's Island, Nun's Island, south shore St. Lawrence River from Mercier Bridge to Victoria Bridge, north shore from Mercier Bridge to Jacques Cartier Bridge). —Dec. 22, 1956, 7.47 a.m. to 4.30 p.m.; cloudy in a.m., overcast in p.m.; temp. 12° to 20°; wind NE, 20-30 m.p.h.; no snow in open country; little shore ice on river, brash ice forming in p.m. 22 observers in 7 parties. Total party hours, 39 (26 on foot, 12½ by car, ½ in boat); total party miles, 107 (32 on foot, 74 by car, 1 in boat).

Mallard, 5; Black Duck, 616; Pintail, 1; Scaup (sp.), 4; Am. Golden-eye, 257; American Merganser, 232; Am. Rough-legged Hawk, 2; Sparrow Hawk, 2; Pigeon Hawk, 1; Ruffed Grouse, 1; Ring-necked Pheasant, 12; Glaucous Gull, 2; Great Black-backed Gull, 72; Herring Gull, 385; Ring-billed Gull, 4; Bonaparte's Gull, 4; Screech Owl, 1; Great Horned Owl, 1; Short-eared Owl, 1; Hairy Woodpecker, 5; Downy Woodpecker, 4; Am. Crow, 9; Black-capped Chickadee, 4; Brown Creeper, 8; Am. Robin, 8; Cedar Waxwing, 27; Northern Shrike, 1; Common Starling, 201; House Sparrow, 174; Song Sparrow, 1. Total, 30 species; 2,044 individuals. (Seen in area during count period: Red-breasted Merganser, White-breasted Nuthatch, Pine Grosbeak).

—A.J. Bain, H.C. Bare, Miss S. Boyer, Mrs. H.E. Chalk, J.D. Cleghorn, P.H. DuBoulay, Miss I.M. Dunbar, J.W. Evans, J.L. Hill, J. Howes, H.A.C. Jackson, A.W.B. Kelly, J.K. Lowther, Mrs. J.K. Lowther, I.A. McLaren (compiler), G.H. Montgomery, J. Montgomery, J.W. Robinson, D. Ryan, H.F. Seymour, J.F. Skidmore, Miss W.E. Wilson (Province of Quebec Society for the Protection of Birds).

Quebec, Que. (Same as 1955: Ste. Foy to Quebec bridge, Quebec seaport to Island of Orleans bridge, Plains of Abraham and Quebec Zoological Garden; town suburbs 15%, fields 15%, coniferous forests 15%, deciduous woods 3%, mixed woodlands 27%, shores 25%). —Dec. 26, 1956, 7 a.m. to 3 p.m.; clear to cloudy; temp. -5° to 20°; wind W, 6-8 m.p.h.; 6-12 inches of snow on ground; small rivers not completely frozen; abundant moving ice-fields on St. Lawrence River. 22 observers in 5 parties. Total party hours, 24 (21 on foot, 3 by car); total party miles, 51 (21 on foot, 30 by car).

Am. Golden-eye, 1; Am. Rough-legged Hawk, 1; Gyrfalcon, 1 (P.G. and F.H.); Ruffed Grouse, 4; Iceland Gull, 4; Herring Gull, 15; Hairy Woodpecker, 3; Downy Woodpecker, 1; Artic Three-toed Woodpecker, 1; Blue Jay, 8; Am. Crow, 47; Black-capped Chickadee, 25; Red-breasted Nuthatch, 9; Brown Creeper, 1; Northern Shrike, 1; Common Starling, 1,096; House Sparrow, 412; Purple Finch, 75; Pine Grosbeak, 4; Common Redpoll, 206; Pine Siskin, 28; Am. Goldfinch, 10; White-winged Crossbill, 13; Song Sparrow, 2. Total, 24 species; 1,968 individuals. (Seen in area Dec. 22, Richardson's Owl, 1; Dec. 20, Evening Grosbeak, 1; Dec. 16, Swamp Sparrow, 1).

—Gemma Ampleman, Benoit Asselin, Guy Boucher, Pierrette Bouffard, Monique Bourret, Raymond Cayouette (compiler), Jacqueline Darveau, Rolland Dumais, Claude Dumais, Mr. and Mrs. J.-M. Gauvreau, Paul Germain, François Hamel, Louis Lemieux, Louis-A. Lord, Hélène Marceau, Gaston Moisan, Jacques Normandin, Henri Ouellet, Réginald Ouellet, Claire Robitaille, and Lucie Samson (Club des Ornithologues).

Bancroft, Ont. (15 mile radius of town mainly along Hwy. 28, south to Paudash Lake; deciduous wood, 30%; spruce and tamarack bogs 30%; farmland and pasture 20%; town and suburbs 20%). — Dec. 23, 1956, 8.30 a.m. to 4.30 p.m.; overcast, fog.; temp. 20° to 25°; snow melted in open, 4-6 inches in bush; all waters frozen except river. 1 observer in 1 party. Total party hours, 8 (5 on foot, 3 by car); total party miles, 59 (9 on foot, 50 by car).

Ruffed Grouse, 2; Richardson's Owl, 1; Pileated Woodpecker, 1; Hairy Woodpecker, 2; Downy Woodpecker, 2; Blue Jay, 19; Common Raven, 2; Black-capped Chickadee, 18; White-breasted Nuthatch, 3; Red-breasted Nuthatch, 1; Brown Creeper, 3; Common Starling, 18; Am. Goldfinch, 14; Tree Sparrow, 8. Total, 14 species; 94 individuals.

—Earl Stark (compiler).

Brockville, Ont. (Seven-and-one-half-mile radius from King and Broad Streets, Brockville, including all of the St. Lawrence River but none of the American mainland. 20% of area open water; 50% open farmland; 20% deciduous woodland; 7% coniferous woodland; 1½% marsh; 1½% urban; all inland lakes frozen). —Dec. 29, 1956, 8.00 a.m. to 4.30 p.m.; overcast a.m. sunny 11 a.m. on; temp. 13° to 20°; wind NE, 20 m.p.h.; 3" hard snow, inland lakes frozen. 20 observers in 8 parties and 1 feeding station. Total party hours, 62½ (35 on foot, 24 by car, 3½ by boat); total party miles, 372 (57½ on foot, 271½ by car, 25 by boat).

Black Duck, 8; Greater Scaup, 150; Am. Golden-eye, 752; American Scoter, 2; American Merganser, 30; Bald Eagle, 1; Ruffed Grouse, 24; Great Black-backed Gull, 1; Herring Gull, 62; Great Horned Owl, 1; Pileated Woodpecker, 1; Hairy Woodpecker, 9; Downy Woodpecker, 10; Arctic Three-toed Woodpecker, 1; Blue Jay, 56; Black-capped Chickadee, 157; White-breasted Nuthatch, 12; Brown Creeper, 4; Golden-crowned Kinglet, 15; Northern Shrike, 8; Common Starling, 331; House Sparrow, 485; Am. Goldfinch, 8; Slate-colored Junco, 5; Tree Sparrow, 181; Song Sparrow, 1; Snow Bunting, 235. Total, 27 species; 2,549 individuals. The two American Scoter were seen by an expert observer, an employee of the Canadian Wildlife Service in Newfoundland who is familiar with this species. Features noted were the absence of white on head and wing; general profile in flight.

—Ian Clark, David Hurrie, H.H. Dewar, M. Jarvie, R.F. Mucklestone, James Bayly (compiler), Mrs. H.H. Dewar, Mrs. M. Jarvie, Mrs. Beattie, Mrs. E. Wiltsie (all of Brockville); A. Strong of Westport; George Stirrett, John Cartwright, Walter Lamb, A. Bell, A.E. Garwood, Mrs. C. Quilliam, Miss Mary Lestrange (all of Kingston); S. Peters of Kingston and Newfoundland. A later report was received from Mr. Howard Lapp of Brockville.

Carleton Place, Ont. (7½ mile radius of Town Hall). —Dec. 29, 1956, 9:30 a.m. to 3:00 p.m.; temp. 12° to 15°; wind N, 18 m.p.h. 21 observers in 9 parties. Total party hours, 50; total party miles, 328 (26 on foot, 302 by car).

Mallard, 1; Am. Golden-eye, 4; Hooded Merganser, 2; Ruffed Grouse, 8; Pileated Woodpecker, 2; Hairy Woodpecker, 7; Downy Woodpecker, 3; Blue Jay, 41; Am. Crow, 1; Black-capped Chickadee, 46; White-breasted Nuthatch, 25; Brown Creeper, 1; Golden-crowned Kinglet, 3; Cedar Waxwing, 7; Northern Shrike, 5; Common Starling, 151; House Sparrow, 165; Evening Grosbeak, 1; Purple Finch, 80; Pine Grosbeak, 3; Am. Goldfinch, 128; Tree Sparrow, 5; Song Sparrow, 1; Snow Bunting, 214+. Total, 24 species; 904 individuals.

—Mr. and Mrs. Rowley Frith, Miss Sheila Clarke, Fred Bourguignon, Miss Dill, J.M. Brown, Alan Bland, H. Anderson, John Smith, Eric Mills, D. D. Findlay (compiler), E. H. Ritchie, G.E. Findlay, Mr. McIlwain, Mr. and Mrs. Lighthart, Tim Barnett.

Fort William and Port Arthur, Ont. (7½-mile radius contains both cities, a sector of Lake Superior, and surrounding areas; 12% residential and industrial, 12% peat and muck bogs, 25% farmlands, 43% woodlands (mainly second growth aspen, white birch, jackpine and spruce, with many alder thickets), and 8% water). —Dec. 26, 1956, 8:30 a.m. to 4:30 p.m.; temp. 15° to 34°; wind W to SW, calm to 15 m.p.h.; 1.1 inches snow fell between 10 a.m. and 2 p.m. There was 20 inches of snow on the ground and all waters were frozen except in Lake Superior beyond the breakwaters. 14 observers in 8 parties. Total party hours, 31 (12 on foot, 19 by car); total party miles, 194 (20 on foot, 174 by car).

Glaucous Gull, 1; Herring Gull, 210; Hawk Owl, 1; Snowy Owl, 1; Pileated Woodpecker, 1; Hairy Woodpecker, 7; Downy Woodpecker, 17; Arctic Three-toed Woodpecker, 1; Grey Jay, 3; Blue Jay, 37; Common Raven, 39; Am. Crow, 10; Black-capped Chickadee, 54; Brown-headed Chickadee, 2; Cedar Waxwing, 156; Northern Shrike, 2; Common Starling, 854; House Sparrow, 2,140; Pine Grosbeak, 316; Common Redpoll, 160. Total, 20 species; 4,012 individuals. A Ring-necked Pheasant was seen Dec. 24; an American Three-toed Woodpecker was observed Dec. 30; 2 American Robins and some White-winged Crossbills, on Jan. 1.

—Dr. and Mrs. A.E. Allin, Mr. K. Denis (compiler), Mrs. K. Denis, Norman Denis, C.E. Garton, Mrs. A.F. Hanton, Mrs. W. Knowles, D.B. McKillop, R. Robb, Mrs. C. Rydholm, Louise Rydholm, Miss M. Smith, J. Thompson (Thunder Bay Field Naturalists' Club).

Grimsby Beach, Ont. —Dec. 30, 1956, 10.00 a.m. to 4.15 p.m.; temp. 20°; clear; ground frozen, no snow.

Am. Golden-eye, 1; Old-squaw, 1; Sparrow Hawk, 1; Glaucous Gull, 1; Great Black-backed Gull, 1; Herring Gull, 20; Ring-billed Gull, 28; Screech Owl, 1; Yellow-shafted Flicker, 1; Hairy Woodpecker, 2; Am. Crow, 1; White-breasted Nuthatch, 1; Brown Creeper, 1; Common Starling, 17; House Sparrow, 51; Cardinal, 4; Slate-colored Junco, 4; Tree Sparrow, 2; Song Sparrow, 5. Total, 19 species; 143 individuals.

—George and Glenn Meyers.

Hamilton, Ont. (Same area as former years). —Dec. 30, 1956, 6:45 a.m. to 5:30 p.m.; clear, clouding over in p.m.; temp. 1° to 19°; wind W to SW, up to 10 m.p.h.; ground bare, marshes frozen, harbor open. 61 observers in 28 parties. Total party hours, 158 (140 on foot, 18 by car); total party miles, 428 (189 on foot, 239 by car).

Common Loon, 2; Red-throated Loon, 1; Horned Grebe, 6; Great Blue Heron, 2; Mallard, 118; Black Duck, 108; Redhead, 1; Canvas-back, 1; Greater Scaup, 127; Lesser Scaup, 1; Am. Golden-eye, 118; Buffle-head, 10; Old-squaw, 90; King Eider, 1; White-winged Scoter, 3; Ruddy Duck, 5; Hooded Merganser, 1; American Merganser, 1,940; Red-breasted Merganser, 40; Cooper's Hawk, 3; Red-tailed Hawk, 26; Am. Rough-legged Hawk, 16; Bald Eagle, 1; Marsh Hawk, 6; Sparrow Hawk, 18; Ruffed Grouse, 14; European Partridge, 5; Ring-necked Pheasant, 40; Killdeer, 3; Glaucous Gull, 4; Great Black-backed Gull, 127; Herring Gull, 4,000; Ring-billed Gull, 5; Bonaparte's Gull, 4; Mourning Dove, 2; Screech Owl, 1; Great Horned Owl, 7; Snowy Owl, 2; Long-eared Owl, 9; Belted Kingfisher, 4; Yellow-shafted Flicker, 5; Hairy Woodpecker, 33; Downy Woodpecker, 55; Artic Three-toed Woodpecker, 3; Blue Jay, 87; Am. Crow, 85; Black-capped Chickadee, 373; White-breasted Nuthatch, 8; Red-breasted Nuthatch, 2; Brown Creeper, 34; Winter Wren, 1; Am. Robin, 10; Golden-crowned Kinglet, 40; Ruby-crowned Kinglet, 1; Cedar Waxwing, 17; Northern Shrike, 13; Common Starling, 1,740; House Sparrow, 1,200; Eastern Meadowlark, 16; Rusty Blackbird, 1; Purple Grackle, 2; Cardinal, 116; Common Redpoll, 3; Am. Goldfinch, 43; Eastern Towee, 1; Slate-colored Junco, 820; Tree Sparrow 1,380; Field Sparrow, 1; White-crowned Sparrow, 1; Song Sparrow, 69; Swamp Sparrow, 4; Snow Bunting, 35. Total, 72 species; about 13,072 individuals. Red-necked Grebe, Black-crowned Night Heron, Ring-necked Duck, Goshawk, Sharp-shinned Hawk, Iceland Gull, Red-headed Woopecker, Mockingbird, Myrtle Warbler, Evening Grosbeak, Vesper Sparrow and Chipping Sparrow have also been seen since Christmas.

—Ross Anderson, Frank V. Bell, W.E. Benner, R.D.F. Bourne, Miss Stella Brown, Dr. Frank Buckle, James Cox, Kenneth J. Cox, John Cumming, Robert Curry, Edward Dinniwell, Don Donaldson, James A. N. Dowall, Robert O. Elstone, A. F. Emberley, Robert Finlayson, Mrs. Paul Fish, W. A. T. Gilmour, Leslie A. Gray, Ian Halladay, Peter Hamel, John A. Hencher, Dr. Peter F. Henderson, Mr. and Mrs. William Holley, Angus B. Jackson, H. E. Kettle, Miss Suzanne Lawrie, Thomson C. Lawrie, Miss Margaret Lamb, Mr. and Mrs. Robert Lloyd, John E. H. Martin, Dr. R. G. C. MacLaren, Harold MacPherson, C. Douglas McCallum, Dr. G. O. McMillan, John Miles, Huber Moore, Mrs. Carl M. Morden, John A. Moule, Mr. and Mrs. A. B. Nind, Mr. and Mrs. George W. North (compiler), David K. Powell, Lawrence Roy, Robert K. Sargeant, Mr. and Mrs. Frank Schneider, Douglas Smith, Robert Stamp, Miss Laura Stewart, Danny Strickland, Oliver Strickland, Miss Anne Watson, Miss Jane Watson, Miss Mabel Watson, J. Harvey Williams, Michael Wright, Robert Zavitz (Hamilton Nature Club).

Huntsville, Ont. (50% mixed deciduous-coniferous cutover forest; 25% spruce-tamarack swamp; 25% farm land or old clearings. Water areas mostly frozen; open water in river, especially at rapids). — Dec. 23, 1956, 8 a.m. to 5 p.m.; temp. 25° to 30°; wind E, light; drizzle of freezing rain toward evening, mostly cloudy. 28 observers in 10 parties. Total party hours, 25 (18 on foot, 7 by car); total party miles, 110 (20 on foot, 90 by car).

Am. Golden-eye, 1; Spruce Grouse, 1; Ruffed Grouse, 10; Herring Gull, 3; Pileated Woodpecker, 3; Hairy Woodpecker, 32; Downy Woodpecker, 21; Arctic Three-toed Woodpecker, 1; Am. Three-toed Woodpecker, 2; Grey Jay, 1; Blue Jay, 88; Common Raven, 4; Black-capped Chickadee, 79; White-breasted Nuthatch, 18; Red-breasted Nuthatch, 14; Brown Creeper, 6; Golden-crowned Kinglet, 3; Cedar Waxwing, 25; Northern Shrike, 1; Common Starling, 41; House Sparrow, 65; Common Redpoll, 8; Pine Siskin, 59; Am. Goldfinch, 67; Red Crossbill, 46; White-winged Crossbill, 10; Song Sparrow, 1. Total, 27 species; 610 individuals.

—Mrs. Edgar Brook, Mr. and Mrs. A. C. Conway, Paul Conway, Mrs. M. A. East, Mr. and Mrs. E. Farnsworth, Mrs. G. Hill, Jack Hull, Jerry Jenkins, Mr. and Mrs. Jas. Kay, Mrs.

Langridge, Aubrey May, Nancy May, Mrs. Mills, Mrs. Ross McFarland, Ken Perrin, Dr. and Mrs. Reazin, Mr. and Mrs. E. G. R. Rogers, Russ Rutter (compiler), Mr. and Mrs. W. Waters, Mrs. Geo. Wilson (Huntsville Nature Club; Limberlost Nature Club).

Kingston, Ont. (7½-mile radius centering on MacDonald Park; perimeter touching Westbrook on west, Elginburg on north, and western tip of Howe Island on east; also includes most of western Wolfe Island. Farmland 45%; mixed woodlots 25%; water 20%; marshes 8%; urban 2%; all water open except part of Cataraqui River and lake above Kingston Mills). —Dec. 21, 1956, 7:30 a.m. to 4:30 p.m.; completely overcast all day; temp. 25° to 35°; wind NNE, 15-20 m.p.h.; driving sleet from noon to 3 p.m. 21 observers in 8 parties. Total party hours, 65 (32 on foot, 32 by car, 1 by boat); total party miles, 380 (48 on foot, 326 by car, 6 by boat).

Common Loon, 1; Great Blue Heron, 1; Mallard, 1; Black Duck, 158; Am. Widgeon, 4; Redhead, 322; Canvas-back, 100 ± 20; Greater Scaup, 10,000 ± 1,000; Am. Goldeneye, 467; American Merganser, 327; Red-breasted Merganser, 3; Cooper's Hawk, 1; Am. Rough-legged Hawk, 1; Ruffed Grouse, 5; European Partridge, 9; Glaucous Gull, 3; Great Black-backed Gull, 30; Herring Gull, 465 ± 20; Ring-billed Gull, 270; Great Horned Owl, 1; Snowy Owl, 2; Hairy Woodpecker, 3; Downy Woodpecker, 7; Blue Jay, 22; Black-capped Chickadee, 65; White-breasted Nuthatch, 17; Brown Creeper, 2; Northern Shrike, 5; Common Starling, 629; House Sparrow, 445; Red-winged Blackbird, 5; Am. Goldfinch, 2; Slate-colored Junco, 3; Tree Sparrow, 174; Song Sparrow, 1. Total, 36 species; 13,552 (± 1,040) individuals. (Seen in area during count period: Florida Gallinule, Common Pheasant, Arctic Three-toed Woodpecker, Crow, Ruby-crowned Kinglet, Cedar Waxwing, Eastern Meadowlark.)

—Jim Bailey, Art Bell, Isabelle Boardman, John Bulger, John Cartwright (compiler), Ron Cooley, Ken Edwards, Martin Edwards, Art Hyde, Isabel Hyde, Ann Hutchison, Walter Lamb, Mary L'Estrange, Lou Lowther, Derek Paul, Shirley Peruniak, Helen Quilliam, George Stirrett, Alden Strong, Jack Vincent, Larry Wilson (Kingston Nature Club).

Kirkland Lake, Ont. (7½-mile radius centering on a point on No. 112 Highway one mile north of Dane; fields 20%; towns 5%; coniferous woods 30%; deciduous woods 35%; slimes 5%; cattail marsh 5%; and 4 feeding stations). —Dec. 23, 1956, 7:00 a.m. to 4:45 p.m.; overcast, clearing; temp. 10° to 24°; wind SW, 10 m.p.h.; 17" of snow in open; lakes frozen; some open water in streams. 15 observers in 8 parties. Total party hours, 34 (12 on foot, 13 by car, 9 at feeding stations); total party miles 168 (18 on foot, 150 by car).

American Merganser, 2; Ruffed Grouse, 2; Great Horned Owl, 3; Am. Hawk Owl, 1; Pileated Woodpecker, 1; Hairy Woodpecker, 13; Downy Woodpecker, 9; Grey Jay, 19; Blue Jay, 43; Common Raven, 3; Black-capped Chickadee, 90; Brown-headed Chickadee, 4; Red-breasted Nuthatch, 9; Common Starling, 37; House Sparrow, 25; Evening Grosbeak, 43; Purple Finch, 28; Pine Grosbeak, 99; Common Redpoll, 179; Red Crossbill, 1; White-winged Crossbill, 118; Snow Bunting, 135. Total, 22 species; 864 individuals. (One Arctic Three-toed Woodpecker (male) seen in the area in the count period.) —Mrs. A. Axcell, K.C. Gray, F. M. Helleiner, J. H. Hodgins, R. J. McClanahan, R. J. McClanahan, Jr., P. W. Richter, I. Robertson, J. Savage, J. G. Stephenson (compiler), Mrs. J. G. Stephenson, J. C. Stephenson, Mrs. Robt. Walker, F. Washington, D. Watson (Kirkland Lake Nature Club).

Kitchener, Ont. (7½-mile radius centering on the extreme southwestern boundary of the city; cattail marsh 2%, open farmland and pasture 23%, deciduous woods 25%, coniferous woods 25%, swamp 21%, town suburbs 2%, open water 2%). —Dec. 23, 1956, 8:00 a.m. to 4:30 p.m.; very heavy fog; temp. 32° to 35°; wind E, 10-15 m.p.h.; very poor visibility due to extensive fog; no snow cover; rivers and creeks open with some ponds frozen over. 13 observers in 5 parties. Total party hours, 40½ (36¼ on foot, 4¼ by car); total party miles, 127½ (33½ on foot, 94 by car).

Great Blue Heron, 1; Mallard, 1; Black Duck, 2; American Merganser, 2; Ruffed Grouse, 11; Ring-necked Pheasant, 10; Herring Gull, 22; Great Horned Owl, 2; Long-eared Owl, 10; Belted Kingfisher, 4; Hairy Woodpecker, 1; Downy Woodpecker, 13; Blue Jay, 17; Black-capped Chickadee, 82; White-breasted Nuthatch, 17; Red-breasted Nuthatch, 1; Brown Creeper, 12; Winter Wren, 1; Golden-crowned Kinglet, 47; Common Starling, 7; House Sparrow, 532; Cardinal, 60; Pine Grosbeak, 1; Am. Goldfinch, 152; Slate-colored Junco, 67; Tree Sparrow, 61; Song Sparrow, 12. Total, 27 species; 1,148 individuals.

—J. Bindernagel, H. A. Dahmer (compiler), J. R. Detweiler, F. W. R. Dickson, M. Dickson, R. D. Hendry, R. Hilborn, R. Pickering, M. C. Preston, Dr. J. Sanders, W. H. Scheafer, R. Tilt, S. Underhill (Kitchener-Waterloo Field Naturalists' Club).

London, Ont. (Pasture 45%; plow lands 10%; river 15%; marsh 10%; coniferous 10%; deciduous 10%). —Dec. 29, 1956, 8 a.m. to 5 p.m.; temp. 24° to 31°; wind NNW, 10-15 m.p.h.; cloudy, snowed 3-4 inches during day. 52 observers in 14 parties. Total party hours, 120 (112 on foot, 8 by car); total party miles, 211 (150 on foot, 61 by car).

Great Blue Heron, 4; Mallard, 234; Black Duck, 166; Green-winged Teal, 1; Lesser Scaup, 1; Am. Golden-eye, 44; Hooded Merganser, 7; American Merganser, 49; Cooper's Hawk, 1; Red-tailed Hawk, 20; Red-shouldered Hawk, 2; Am. Rough-legged Hawk, 2; Bald Eagle, 2; Marsh Hawk, 1; Ring-necked Pheasant, 20; Herring Gull, 22; Ring-billed Gull, 2; Mourning Dove, 35; Screech Owl, 1; Great Horned Owl, 1; Long-eared Owl, 1; Belted Kingfisher, 9; Yellow-shafted Flicker, 2; Pileated Woodpecker, 1; Hairy Woodpecker, 27; Downy Woodpecker, 63; Horned Lark, 1; Blue Jay, 25; Am. Crow, 3; Black-capped Chickadee, 148; White-breasted Nuthatch, 17; Brown Creeper, 8; Winter Wren, 2; Golden-crowned Kinglet, 68; Northern Shrike, 1; Common Starling, 582; House Sparrow, 879; Eastern Meadowlark, 1; Cardinal, 252; Evening Grosbeak, 2; Purple Finch, 2; Am. Goldfinch, 40; Eastern Towhee, 1; Slate-colored Junco, 163; Tree Sparrow, 250; Field Sparrow, 14; White-throated Sparrow, 4; Swamp Sparrow, 7; Song Sparrow, 41; Lapland Longspur, 4; Snow Bunting, 17. Total, 51 species; 3,250 individuals. Seen in area: Arctic Three-toed Woodpecker, Dec. 20, 21, 22; Bob-white, Dec. 28; Yellow-bellied Sapsucker, Dec. 30; Short-eared Owl, Dec. 30; Sparrow Hawk, Dec. 30.

—William Girling, T. Verboom, Gleen Pincombe, Lynn Ball, H. Nugent, Dr. Aitken, Dr. Bocking, Dr. and Mrs. G. Cummings, Mr. J. W. Leach (compiler), Mrs. J. W. Leach, Mr. and Mrs. J. C. Higgins, Eli Davis, J. C. Laughton, Glenna Barret, Joyce Simmons, Yvette Walton, Doug. Dow, Paul MacKenzie, G. Muller, R. Haines, R. Lazenby, B. Thompson, Mrs. Bainaro, Mrs. Spruce, Mr. and Mrs. W. Day, M. Comfort, Carol Southern, M. J. Heighway, Dr. W. W. Judd, S. Huston, Mr. and Mrs. Wm. Caspell, Mary Marshall, H. MacMahon, Helen Elliott, Alan Loughrey, Tom Penhale, A. Dunston, Mr. and Mrs. Wm. Maddeford, Ted Maddeford, Charles Maddeford, D. Carr, C. Hobbs, Dr. Hobbs, Ann Thompson, W. D. Sutton, Mr. and Mrs. Wm. Jarmain.

North Bay, Ont. (Township of West Ferris to La Vasse River, City of North Bay, Widdifield and Commanada townships, along Lake Nipissing; settlements 75%, open farmland 5%, mixed second-growth bushland 15%, lakes and rivers 5%). —Dec. 28, 1956; 7.50 a.m. to 4.15 p.m.; cloudy to clear in afternoon; temp. 12° to 16°; wind N., 10 to 18 m.p.h.; ground covered with 8-10 inches soft snow; all fresh water frozen. 5 observers in 1 party. Total party hours, 8 hr. 25 min., (6½ on foot, 1 hr. 55 min. by car); total party miles, 57 (7 on foot, 50 by car).

Richardson's Owl, 1; Pileated Woodpecker, 1; Hairy Woodpecker, 2; Downy Woodpecker, 2; Blue Jay, 8; Am. Crow, 3; Black-capped Chickadee, 15; Red-breasted Nuthatch, 3; Brown Creeper, 1; Common Starling, 210; Am. Goldfinch, 20; White-winged Crossbill, 17. Total, 12 species; about 283 individuals. —Miriam Higgs, Helen Willoughby, R. L. Snow, S. Higgs, Hazel Petty (Nipissing Field Naturalists).

Oshawa, Ont. (From west city limits of Oshawa to Newcastle, on Lake Ontario, forming a radius of 20 miles; from the center of Oshawa to Lake Scugog, east to Pontypool); Dec. 23, 1956; 8.00 a.m. to 4.00 p.m.; temp. 32°-35°; foggy; snow cover 4 to 6 in.; wind light, northwest; 18 observers in 5 parties; total party miles, 254 (on foot, 49; by car, 205).

Red-necked Grebe, 1; Horned Grebe, 1; Great Blue Heron, 8; Canada Goose, 2; Mallard, 18; Black Duck, 107; Pintail, 1; Am. Golden-eye, 31; Old-Squaw, 251; Hooded Merganser, 1; Am. Merganser, 14; Red-breasted Merganser, 2; Sparrow Hawk, 2; Ruffed Grouse, 5; Ring-necked Pheasant, 49; Virginia Rail, 1; Am. Coot, 2; Killdeer, 1; Glaucous Gull, 1; Great Black-backed Gull, 15; Herring Gull, 306; Ring-billed Gull, 54; Mourning Dove, 14; Great Horned Owl, 1; Hairy Woodpecker, 8; Downy Woodpecker, 9; Blue Jay, 41; Am. Crow, 35; Black-capped Chickadee, 361; White-breasted Nuthatch, 1; Brown Creeper, 7; Am. Robin, 2; Golden-crowned Kinglet, 15; Ruby-crowned Kinglet, 1; Northern Shrike, 3; Common Starling, 272; House Sparrow, 432; Eastern Meadowlark, 2; Com. Redpoll, 44; Am. Goldfinch, 27; Slate-colored Junco, 100; Tree Sparrow, 186; Field Sparrow, 11. Total, 44 species; 2,447 individuals. (Two Blue Geese and one Whistling Swan in the district on Dec. 20 could not be found Dec. 23.)

—Mack Armstrong, Alf. Bunker, Charlie Christy, Forest Dilling, Roy Fleming, Fred Ireson, Jake Laird, Brian Nauss, Bill Neal, Glenn Owen, Jim Richards, Ora Sands, George Scott, Til. Stephens, Lloyd Sturch, John Theberge, Ted. Tozer, Ron. Tozer (Oshawa Naturalists' Club).

Ottawa, Ont. (7½-mile radius from Parliament Hill; town and suburbs, farmland, deciduous woods and coniferous woods; open water in and near rapids only). —Dec. 23, 1956, 7:30 a.m. to 4:30 p.m.; temp. 20° to 25°; wind E to NE, 10-22 m.p.h.; heavy low stratus; intermittent freezing drizzle 7:00-9:30 a.m. and 1:00-2:00 p.m.; patchy snow cover in open, to 6 in. in woods. 25 observers in 10 parties. Total party hours, 67¼; total party miles, 356 (64½ on foot, 291½ by car).

Mallard, 4; Black Duck, 59; Am. Golden-eye, 168; Old-squaw, 1; Hooded Merganser, 1; American Merganser, 47; Am. Rough-legged Hawk, 1; Ruffed Grouse, 10; Ring-necked Pheasant, 11; Iceland Gull, 3; Herring Gull, 5; Barred Owl, 1; Pileated Woodpecker, 2; Hairy Woodpecker, 10; Downy Woodpecker, 10; Blue Jay, 63; Am. Crow, 29; Black-capped Chickadee, 78; White-breasted Nuthatch, 23; Red-breasted Nuthatch, 1; Brown Creeper, 9; Am. Robin, 1; Cedar Waxwing, 23; Northern Shrike, 2; Common Starling, 3,287; House Sparrow, 2,963; Bronzed Grackle, 1; Evening Grosbeak, 1; Common Redpoll, 17; Pine Siskin, 12; Am. Goldfinch, 4; Tree Sparrow, 16; Song Sparrow, 6. Total, 33 species, 6,879 individuals. Seen during census period: Sparrow Hawk, Great Black-backed Gull and Snow Bunting.

—Miss A. Banning, A. Bland, A. E. Bourguignon, Mrs. F. W. G. Clark, Miss S. M. Clark, S. Davis, C. Frankton, Mrs. C. Frankton, R. E. Frith, W. E. Godfrey, J. W. Groves, Miss V. Humphreys, H. Lloyd, L. MacKinnon, D. A. MacLulich, B. Millman, P. Millman, E. Mills, F. Munro, Miss B. Salter, D.B.O. Savile (compiler), Mrs. D.B.O. Savile, M.D. Spencer, J. E. Tener.

Peterborough, Ont. (Open fields 45%, swamp 24%, water 10%, coniferous woods 2%, deciduous woods 4%, mixed woods 14%). —Dec. 29, 1956, 8:30 a.m. to 4:30 p.m.; temp. 0° to —10°; wind NW, 5-15 m.p.h.; 3-5 in. snow. Lakes frozen. River mainly open. 22 observers in 8 parties. Total party hours, 29; total party miles, 260 (22 on foot, 238 by car).

American Merganser, 8; Goshawk, 1; Sparrow Hawk, 1; Ruffed Grouse, 4; Herring Gull, 28; Great Horned Owl, 1; Richardson's Owl, 1; Pileated Woodpecker, 2; Hairy Woodpecker, 7; Downy Woodpecker, 10; Arctic Three-toed Woodpecker, 4; Blue Jay, 63; Black-capped Chickadee, 116; White-breasted Nuthatch, 2; Northern Shrike, 2; Common Starling, 93; House Sparrow, 250; Am. Goldfinch, 9; White-winged Crossbill, 36; Tree Sparrow, 96; Snow Bunting, 51. Total, 21 species; 785 individuals. Following seen recently but not on actual census date: Barred Owl, 1, Dec. 24; Am. Three-toed Woodpecker, 1, Dec. 26; Robin, 1, Dec. 27.

—F. R. Pammett (compiler), J. L. McKeever, Derek McKeever, E. Whitely, Walter Whitely, M. V. Powell, D. Sadler, Mrs. D. Sadler, G. Greene, Mrs. G. Greene, R. Scrutton and son, J. H. Johnson, R. Chandler, Terry Smith, S. Bond, K. Baker, Miss H. Harmsworth, W. Smith, Mr. and Mrs. E. T. Newsom.

Pickering Township, Ont. (15 acres of mixed woodland: white cedar 20%, hemlock 20%, poplar-birch-ironwood-maple 45%, uncultivated fields 15%. 3 miles of country roads: fields 50%, mixed woodland 50%, including 3 bird-feeding stations). —Jan. 1, 1957, 7:15 a.m. to 5:00 p.m.; clear; temp. —14° to —6°; wind N, 10-12 m.p.h.; 4 in. fresh snow on ground, ponds and creek frozen. 2 observers in 2 parties. Total party hours, 11 (1 on foot, 1 by car, 9 at feeding stations); total party miles, 4 (1 on foot, 3 by car).

Sharp-shinned Hawk, 1; Ruffed Grouse, 2; Hairy Woodpecker, 3; Downy Woodpecker, 6; Blue Jay, 13; Black-capped Chickadee, 20; Golden-crowned Kinglet, 4; Northern Shrike, 2; House Sparrow, 10; Cardinal, 13; Am. Goldfinch, 2; Slate-colored Junco, 30; Oregon Junco, 2; Tree Sparrow, 7. Total, 14 species; 116 individuals.

—J. Murray Speirs and Doris H. Speirs (compiler).

Richmond Hill, Ont. (Area limited to 4 sections, each 1¼ square miles). —Dec. 26, 1956; temp. 30°; sunny, calm.

Marsh Hawk, 1; Sparrow Hawk, 3; Red-tailed Hawk, 1; Pheasant, 1; Herring Gull, 1; Great Horned Owl, 1; Long-eared Owl, 4; Yellow-shafted Flicker, 1; Hairy Woodpecker, 2; Downy Woodpecker, 11; Blue Jay, 12; Am. Crow, 1; Black-capped Chickadee, 54; White-breasted Nuthatch, 2; Red-breasted Nuthatch, 1; Brown Creeper, 3; Common Starling, 45; English Sparrow, 144; Eastern Meadowlark, 3; Cardinal, 5; Am. Goldfinch, 13; Slate-colored Junco, 37; Tree Sparrow, 135; Song Sparrow, 10. Total, 24 species; 491 individuals.

Seen within the week previous to census but not on census day: Northern Shrike, Golden-crowned Kinglet, Brown Thrasher, Cooper's Hawk, and Rough-legged Hawk.

—Mrs. Peter Addison, Secretary, Richmond Hill Naturalists.

Rutherglen, Ont. (From Township of Bonfield, villages of Bonfield and Rutherglen, areas around Pimisi Bay and rivers Kaipuskong, Mattawa, Amable du Fond, and Ottawa, to town of Mattawa; open farmland 10%; mixed second-growth forest 50%; marshes and bogs 5 %; lakes and rivers 20 %; settlements 15%). —Dec. 28, 1956, 7:45 a.m. to 4 p.m.; snowflurries to cloudy; temp. 24° to 25°; wind NW to N, 2-5 m.p.h.; ground covered with 10 in. soft snow; all fresh water except rapids and the Ottawa River frozen. 2 observers in 1 party. Total party hours, 8¼ (7 on foot, 1¼ by car); total party miles, 53 (8 on foot, 45 by car).

Mallard, 5; Black Duck, 70; Am. Golden-eye, 16; American Merganser, 1; Red-breasted Merganser, 1; Ruffed Grouse, 1; Hairy Woodpecker, 15; Downy Woodpecker, 4; Blue Jay, 23; Common Raven, 1; Am. Crow, 6; Black-capped Chickadee, 5; Red-breasted Nuthatch, 6; Brown Creeper, 3; Common Starling, 16; House Sparrow, 1; Evening Grosbeak, 42; Purple Finch, 10; White-winged Crossbill, 6; Snow Bunting, 8. Total, 20 species; approximately 240 individuals. Seen in area, Dec. 26: American Goldfinch, 37.

—Sheldon McLaren and Louise de Kiriline Lawrence (compiler) (Nipissing Field-Naturalists' Club).

Toronto, Ont. (The 32nd annual Brodie Club count over 27 established routes extending west to Clarkson, north to Vivian, and east to Whitby). —Dec. 23, 1956, 7:15 a.m. to 5 p.m.; temp. 32° to 34°; wind NE, 9 m.p.h.; visibility poor due to the heavy fog, ground bare and muddy. Bay open, creeks mostly open. 112 observers in 27 parties. Total party hours, 152 (average 5.67 hours per party).

Horned Grebe, 2; Great Blue Heron, 6; Mallard, 924; Black Duck, 665; Redhead, 16; Canvas-back, 11; Greater Scaup, 1,529; Am. Golden-eye, 473; Buffle-head, 111; Old-squaw, 1,533; Harlequin Duck, 1; White-winged Scoter, 1; American Merganser, 138; Red-breasted Merganser, 19; Sharp-shinned Hawk, 1; Cooper's Hawk, 1; Red-tailed Hawk, 8; Red-shouldered Hawk, 1; Am. Rough-legged Hawk, 6; Peregrine Falcon, 1; Sparrow Hawk, 17; Ruffed Grouse, 10; Ring-necked Pheasant, 93; Glaucous Gull, 6; Iceland Gull, 2; Great Black-backed Gull, 23; Herring Gull, 2,744; Ring-billed Gull, 324; Screech Owl, 1; Great Horned Owl, 6; Barred Owl, 2; Long-eared Owl, 15; Belted Kingfisher, 8; Yellow-shafted Flicker, 1; Pileated Woodpecker, 5; Hairy Woodpecker, 68; Downy Woodpecker, 114; Arctic Three-toed Woodpecker, 8; Am. Three-toed Woodpecker, 1; Blue Jay, 102; Am. Crow, 19; Black-capped Chickadee, 283; White-breasted Nuthatch, 18; Red-breasted Nuthatch, 1; Brown Creeper, 29; Winter Wren, 3; Carolina Wren, 2; Catbird, 1; Am. Robin, 4; Golden-crowned Kinglet, 36; Northern Shrike, 15; Common Starling, 5,507; House Sparrow, 1,402; Eastern Meadowlark, 4; Red-winged Blackbird, 2; Cardinal, 75; Am. Goldfinch, 56; Slate-colored Junco, 277; Oregon Junco, 3; Tree Sparrow, 544; Field Sparrow, 2; White-throated Sparrow, 2; Swamp Sparrow, 1; Song Sparrow, 100. Total, 64 species; 17,383 individuals. Harlequin Duck and Am. Three-toed Woodpecker additions to the club's Christmas Bird Count (now 135 species for the 32 counts).

—G. Anderson, J. L. Baillie (compiler), R. Bateman, H. Barnett, J. Barnett, O.D. Boggs, J. Brennan, N. Brown, Ralph Brown, Bill Brown, Ruth Brown, D. Burton, L. Butcher, H. Byrd, V. Carter, C. H. D. Clarke, L. Clarke, R. Corlett, F. Crawford, C. Davies, I. Davies, A. Dawe, R. H. Emery, G. Fairfield, J. Fairfield, A. Falls, J. B. Falls, T. Farley, B. Foster, C. D. Fowle, J. D. Fowle, A. Gatti, C. Goodwin, D. Gunn, C. Halliday, H. M. Halliday, M. Halliday, R. Hansell, D. Hanson, Paul Harrington, Peter Harrington, P. Higgins, W. Higgins, H. Hogg, D. Hughes, C. N. Ireson, G. Ireson, R. James, R. Knights, H. Lawrence, B. LeVay, F. LeVay, J. LeVay, N. LeVay, D. Lewis, G. Littlejohn, C. Long, S. Long, B. Mackay, D. Mackay, P. Mackay, J. R. Mackintosh, M. Marsh, W. Martin, J. Mayall, K. Mayall, R. McCleary, T. F. McIlwraith, A. Mitchener, P. Nelson, G. Page, P. Page, R. Pannell, R. Pepall, D. Perks, J. Purkis, W. Renison, H. Richards, D. Ripley, R. C. Ritchie, R. M. Saunders, D. Scovell, F. Sharp, J. Sherrin, T. M. Shortt, J. Smith, W. W. Smith, H. Southam, D. H. Speirs, J. M. Speirs, R. Stapleton, B. Stupart, M. Summers, E. H. Taylor, R. M. Taylor, Robt. Taylor, R. Trowern, N. Verbook, E. Waltho, J. Walty, T. Warren, E. Wasserfall, W. Wasserfall, E. Welch, D. A. West, J. D. West, B. Westcott, W. Williams, Roy Wilson, J. Woodford, K. Young.

West Lorne, Ont. (Circle with 7½-mile radius centered one mile north of West Lorne, covering parts of the townships of Dunwich and Aldborough in Elgin and Mosa and Elfrid in Middlesex). —Dec. 26, 1956; temp. 25° to 32°; wind S. to SW., 10 to 25 m.p.h.; snowing; 2 in. snow on ground; ponds frozen; running streams and Lake Erie free of ice. 13 observers in 5 parties; total party hours, 37 (21 on foot, 16 by car); total party miles, 141 (21 on foot, 120 by car).

Horned Grebe, 1; Canada Goose, 2; Black Duck, 1; Am. Golden-eye, 63; Red-breasted Merganser, 1; Sharp-shinned Hawk, 2; Red-tailed Hawk, 11; Common Rough-legged Hawk, 6; Bald Eagle, 2; Marsh Hawk, 2; Ruffed Grouse, 2; Bob-white, 128; Common Pheasant, 1; Herring Gull, 27; Mourning Dove, 99; Screech Owl, 1; Great Horned Owl, 3; Yellow-shafted Flicker, 9; Pileated Woodpecker, 2; Red-bellied Woodpecker, 3; Hairy Woodpecker, 10; Downy Woodpecker, 36; Blue Jay, 31; Am. Crow, 8; Black-capped Chickadee, 41; White-breasted Nuthatch, 7; Brown Creeper, 8; Golden-crowned Kinglet, 17; Northern Shrike, 1; Common Shrike, 1; Common Starling, 260; House Sparrow, 738; Eastern Meadowlark, 14; Red-winged Blackbird, 1; Cowbird, 1; Cardinal, 134; Am. Goldfinch, 39; Eastern Towhee, 1; Slate-colored Junco, 344; Tree Sparrow, 220; Field Sparrow, 4; Fox Sparrow, 2; Song Sparrow, 39. Total, 43 species; 2,323 individuals.

—Donald Johnson, Edwin Graff, Florence Graff, H. S. Lancaster, Garry Martell, T. Merritt, John Lemon, R. E. Lemon, V. E. Lemon, D. Murray (compiler), J. Murray, D. Shostock, J. Shostock (The West Elgin Nature Club).

Westport, Ont. (7½-mile radius centering on village municipal office; farmland 15%, lakes 20%, marshes 5%, deciduous woodland 40%, mixed woodland 18%, Red Cedar groves 2%). —Dec. 30, 1956; 8 a.m. to 4 p.m. Clear; temp. —15° to 5°; wind N, 5 m.p.h.; ground with 4 in. snow; marshes, lakes and rivers only recently frozen; unusually high temperature for preceding month. Thirteen observers in 6 parties. Total party hours, 43 (20 on foot, 23 by car); total party miles, 278 (28 on foot, 250 by car).

Goshawk, 1; Red-tailed Hawk, 1; Sparrow Hawk, 1; Ruffed Grouse, 22; Pileated Woodpecker, 2; Hairy Woodpecker, 14; Downy Woodpecker, 6; American Three-toed Woodpecker, 1 (G.M.S.); Blue Jay, 34; Black-capped Chickadee, 96; White-breasted Nuthatch, 15; Brown Creeper, 3; Winter Wren, 1; Am. Robin, 2; Cedar Waxwing, 18; Gray Shrike, 3; Common Starling, 23; House Sparrow, 201; Evening Grosbeak, 1; Pine Siskin, 6; Am. Goldfinch, 10; White-winged Crossbill, 7; Slate-colored Junco, 8; Am. Tree Sparrow, 77; Song Sparrow, 2; Snow Bunting, 200. Total, 26 species; about 750 individuals. —F. Arnold, J. Bayly, A. Bell, J. Cartwright, D. Crawford, J. Hannah, D. MacDougall, P. J. McManus, L. Nichol, G. M. Stirrett, A. M. Strong (compiler).

Carlton, Sask. (7½-mile radius centering 2½ miles west and 2½ miles south of Carlton; frozen North Saskatchewan River, 5% (from 1 mile above Laird ferry to 1 mile below Carlton ferry), deciduous woods 20%, open farmland, 75%. A few conifers along river bank). —Dec. 30, 1956; 7:30 a.m. to 5 p.m. mostly sunny; temp. 34 to 38°; wind W, 10 to 20 m.p.h.; two inches snow on open fields; five inches snow in woods. 11 observers in 4 parties. Total party hours, 26½ (13 on foot, 13½ by car); total party miles, 115 (22 on foot, 93 by car).

Goshawk, 3; Golden Eagle, 4; Ruffed Grouse, 3; Sharp-tailed Grouse, 14; European Partridge, 4; Great Horned Owl, 1; Snowy Owl, 4; Hairy Woodpecker, 3; Downy Woodpecker, 4; Blue Jay, 1; Am. Magpie, 46; Common Raven, 1; Black-capped Chickadee, 23; Bohemia Waxwing, 7; Northern Shrike, 1; House Sparrow, 258; Pine Grosbeak, 64; Common Redpoll, 155; Snow Bunting, 46. Total, 19 species, 642 individuals. A small Accipiter, almost certainly Sharp-shinned, noted by Ed. Brooman.

—Ed Brooman, Elias Evasiuk, Tony Capusten, Mel Welsh (Prince Albert Natural History Society); Jonathan Gerrard, Dr. John Gerrard, J. R. Hogg, J. Frank Roy, John Shadick (Saskatoon Natural History Society); Dr. and Mrs. Stuart Houston (compilers) (Yorkton Natural History Society).

Saskatoon, Sask. (A circle with radius of 7½ miles, centered 2 miles S of Saskatoon to include mouth of Beaver Creek, wooded banks on either side of S. Saskatchewan River, and Moon Lake. Included Forestry Farm, 3 golf courses, open fields, and the parklands and prairie S and W of city). — Dec. 26, 1956, 7:30 a.m. to 4:30 p.m.; 9 hours; temp. 35° to 36°; wind SW, 12 m.p.h.; sunny at beginning, becoming overcast by noon. Wind constant. About 6 in. of snow on level. 27 observers in 6 parties. Total party hours, 35½ (18 on foot, 17½ by car); total party miles, 228 (23 on foot, 205 by car).

Mallard, 8; Ruffed Grouse, 1; Sharp-tailed Grouse, 23; European Partridge, 52; Ring-necked Pheasant, 1; Pigeon Hawk, 1; Great Horned Owl, 1; Hairy Woodpecker, 5; Downy Woodpecker, 2; Am. Magpie, 82; Am. Crow, 2; Black-capped Chickadee, 11; Bohemian Waxwing, 136; Cedar Waxwing, 20; Northern Shrike, 2; English Sparrow, 2,315; Pine Grosbeak, 73; Common Redpoll, 26; Snow Bunting, 50. Total, 19 species, 2,811 individuals. Of special interest were the Wintering Pigeon Hawk (checked by 5 observers, including the compiler); the 20 Cedar Waxwings, 2 Wintering Crows and the 8 Mallards on the open water below the power house.

—Dr. R.W. Bremner, Mr. and Mrs. Glen Burgess, R. Burgess, Dr. and Mrs. J. Gerrard, Jonathan and Peter Gerrard, George and Ross Gerrity, Mr. and Mrs. Vic Harper, Mr. and Mrs. B. Hinde, Mary Hinde, Jim Hogg, J. Moore, Ralph Morris, Bob Pravda, Frank Roy (compiler), Dr. and Mrs. L. G. Saunders, John Shadick, Dr. E. Wait, R. Wait, H. W. Wickenden, Mrs. M. Younger (Saskatoon Natural History Society).

Yorkton, Sask. (7½-mile radius centering on Yorkton; same area as previous years). — Dec. 26, 1956, 8 a.m. to 5:30 p.m.; mostly sunny; temp. 32° to 36°; wind W, 10 to 20 m.p.h.; ground covered with 20 in. snow. 14 observers in 6 parties. Total party hours, 19½ (10½ on foot, 9 by car); total party miles, 62 (11 on foot, 51 by car).

Ruffed Grouse, 9; Sharp-tailed Grouse, 63; European Partridge, 17; Great Horned Owl, 2; Snowy Owl, 1; Hairy Woodpecker, 1; Downy Woodpecker, 1; Blue Jay, 4; Am. Magpie, 25; Black-capped Chickadee, 25; Bohemian Maxwing, 5; Northern Shrike, 1; House Sparrow, 289; Pine Grosbeak, 2; Common Redpoll, 8; Snow Bunting, 89. Total, 16 species; 542 individuals.

—Wayne Bjorgan, Brother Clarence, Brother Clement, Henry Chilman, Jr., Ronald Coleman, Tom Cursons, Archie Fraser, Art Gellert, Dr. and Mrs. Stuart Houston (compilers), Phil Pawluck, Bob Pearce, Cliff Shaw, Jeff Smith (Yorkton Natural History Society).

Edmonton, Alberta. (7½-mile radius). — Dec. 23, 1956. 8 a.m. to 5 p.m.; overcast, wind NW, 7 m.p.h.; temp. 15° to 23°; twenty-four observers in eight parties. Total party hours, 23 (18 on foot, 5 by car). Mallard, 48; Golden Eagle, 1; Pigeon Hawk, 1; Ruffed Grouse, 3; Ring-necked Pheasant, 10; Horned Owl, 1; Snowy Owl, 1; Pileated Woodpecker, 1; Hairy Woodpecker, 2; Downy Woodpecker, 3; Am. Three-toed Woodpecker, 1; Blue Jay, 21; Magpie, 82; Black-capped Chickadee, 85; Brown-headed Chickadee, 3; Red-breasted Nuthatch, 1; Am. Robin, 1; Bohemian Waxwing, 514; Northern Shrike, 3; Common Starling, 2; House Sparrow, 91; Evening Grosbeak, 2; Pine Grosbeak, 36; Common Redpoll, 125; White-Winged Crosbill, 34. Total 25 species, 1,072 individuals.

—A. Allen, G. Ball, K. Ball (compiler), A. Blades, E. Blades, H. Campbell, C. Eder, M. Forge, H. Habgood, C. Hampson, M. Hampson, R. Heath, O. Hohn, E. Jones, S. Keith, R. Lister, R. Lumsden, H. Macgregor, K. MacLennon, H. Montgomery, A. Scott, C. Tebby, R. Turner, J. Williams.

Comox, B.C. (Practically same as for past 30 years; from Courtenay (old Logging Ry. Bridge) to head of Comox Bay, along river to mouth and then shore line to head of Bay with side trips through adjoining cultivated lands and to logged area by Comox Village Garbage Dump). — Dec. 26, 1956, 8:30 a.m. to 4 p.m.; temp. 40° to 44°; wind E to SE, light; weather exceptionally mild this month with occasional heavy winds but no quantity of rain though snow. 4 observers in 2 parties. Total party hours, 14½ (mainly on foot using car from place to place); total party miles, 16.

Common Loon, 4; Red-throated Loon, 2; Red-necked Grebe, 7; Eared Grebe, 7; Western Grebe, 2; Pelagic Cormorant, 11; Great Blue Heron, 4; Mallard, 265 *; Pintail, 2; Am. Widgeon, 400 *; Greater Scaup, 75 *; Am. Golden-eye, 77 *; Barrow's Golden-eye, 6; Buffle-head, 8; White-winged Scoter, 125 *; Surf Scoter, 250 *; Hooded Merganser, 2; American Merganser, 6; Red-breasted Merganser, 3; Sharp-shinned Hawk, 1; Bald Eagle, 1; Pigeon Hawk, 2; Ruffed Grouse, 1; Ring-necked Pheasant, 2; Am. Coot, 44; Killdeer, 20; Spotted Sandpiper, 1; Glaucous-winged Gull, 500; Thayer's Gull, 32; Short-billed Gull, 80; Marble Murrelet, 1; Belted Kingfisher, 4; Red-shafted Flicker, 12; Downy Woodpecker, 3; Am. Crow, 2; Northwestern Crow, 100; Chestnut-backed Chickadee, 57; Winter Wren, 12; Bewick's Wren, 6; Am. Robin, 58; Varied Thrush, 6; Golden-crowned Kinglet, 12; Northern Shrike, 1; House Sparrow, 12; Western Meadowlark, 1; Brewer's Blackbird, 100; Evening Grosbeak, 2 flocks; Purple Finch, 10; House Finch, 2; Pine Siskin, 450; Oregon Junco, 17; Fox Sparrow, 1; Song Sparrow, 12. Total 52 species.

* In cases of these ducks numbers not representative as unidentified birds would have numbered 1,500-2,000; one lot of 800 approximately, apparently chiefly Mallard and Widgeon, the balance mainly White-winged and Surf Scoters. No individual count possible. Dec. 25 Common Starlings.
—D. Guthrie, J. Hames, H. Hames, Theed Pearse (compiler).

Crescent Beach, B.C. (Crescent Beach and Blackie's Spit, coast and bush, Ocean Park, White Rock pier and mouth of Campbell Creek, Nicamekl River at Elgin). — Dec. 28, 1956, 8:30 a.m. to 3:30 p.m.; temp. 34° to 38°; wind all day; very thick fog all day, visibility very poor. 7 observers in 2 parties. Total party hours, 9 (8½ on foot, ½ by car); total party miles, 22 (7 on foot, 15 by car).

Common Loon, 7; Red-necked Grebe, 9; Horned Grebe, 13; Western Grebe, 8; Great Blue Heron, 6; Mallard, 1; Greater Scaup, 15; Am. Golden-eye, 8; Barrow's Golden-eye, 1; Buffle-head, 5; Old-squaw, 2; Harlequin Duck, 7; White-winged Scoter, 10; Surf Scoter, 8; American Scoter, 2; Red-breasted Merganser, 10; Ring-necked Pheasant, 1; Red-backed Sandpiper, 50+; Glaucous-winged Gull, 10; Red-shafted Flicker, 2; Downy Woodpecker, 1; Northwestern Crow, 22; Black-capped Chickadee, 26; Chestnut-backed Chickadee, 2; Bewick's Wren, 2; Varied Thrush, 3; Ruby-crowned Kinglet, 1; Common Starling, 100+; House Sparrow, 13; Brewer's Blackbird, 2,000+; Purple Finch, 30; Spotted Towhee, 5; Oregon Junco, 38; Song Sparrow, 6. Total, 34 species; 2,424+ individuals. First record in this area for Common Starling. Three flocks flew overhead towards the south. Am. Robin on Dec. 27.

—M.W. Holdom (compiler), John Simeon, Richard Simeon, Tom Stevens, Hendrick Newnhouse, E.E. Woodford, Miller Lougheed.

Vancouver, B.C. — Dec. 26, 1956; temp. 45°; wind very light, southwest; 30 observers in 10 parties.

Common Loon, 42; Arctic Loon, 25; Red-throated Loon, 12; Red-necked Grebe, 4; Horned Grebe, 258; Eared Grebe, 33; Western Grebe, 568; Pied-billed Grebe, 1; Double-crested Cormorant, 226; Pelagic Cormorant, 55; Great Blue Heron, 52; Mallard Duck, 912; Baldpate, 320; Pintail, 914; Green-winged Teal, 13; Shoveller, 2; Wood Duck, 11; Greater Scaup Duck, 2,868; American Golden-eye, 535; Barrow's Golden-eye, 249; Buffle-head, 149; Old-squaw, 11; Harlequin Duck, 10; White-winged Scoter, 128; Surf Scoter, 742; American Scoter, 151; Ruddy Duck, 8; Hooded Merganser, 15; American Merganser, 3; Red-breasted Merganser, 294; Cooper's Hawk, 1; Sharp-shinned Hawk, 3; Red-tailed Hawk, 1; Golden Eagle, 1; Bald Eagle, 3; Marsh Hawk, 1; Duck Hawk, 2; Pigeon Hawk, 1; Sparrow Hawk, 1; Ring-necked Pheasant, 19; Coot, 310; Killdeer, 157; Black Turnstone, 85; Wilson Snipe, 7; Sanderling, 200; Glaucous-winged Gull, 12,888+; Herring Gull, 455; California Gull, 11; Short-billed Gull, 3,856; Bonaparte's Gull. 687; California Murre, 23; Pigeon Guillemot, 31; Marbled Murrelet, 83; Screech Owl, 3; Great Horned Owl, 1; Short-eared Owl, 11; Saw-whet Owl, 2; Belted Kingfisher, 11; Red-shafted Flicker, 68; Pileated Woodpecker, 5; Hairy Woodpecker, 6; Downy Woodpecker, 9; Steller's Jay, 24; Raven, 2; Crow, 295; Black-capped Chickadee, 176; Chestnut-backed Chickadee, 111; Red-breasted Nuthatch, 4; Brown Creeper, 7; Winter Wren, 22; Bewick's Wren, 16; Robin, 2,690; Varied Thrush, 86, Ruby-crowned Kinglet, 131; Golden-crowned Kinglet, 116; Cedar Waxwing, 228; Northern Shrike, 4; Common Starling, 8,518; Crested Mynah, 52; House Sparrow, 338; Western Meadowlark, 31; Red-winged Blackbird, 244; Brewer's Blackbird, 523; Evening Grosbeak, 317; Purple Finch, 465; House Finch, 347; Pine Siskin, 58; Oregon Towhee, 57; Slate-colored Junco, 5; Oregon Junco, 551; White-crowned Sparrow, 19; Golden-crowned Sparrow, 53; Fox Sparrow, 65; Lincoln's Sparrow, 3; Song Sparrow, 321. Total, 95 species; 43,427 individuals.

—Mr. and Mrs. G.B.H. Stevens, Mr. and Mrs. Noel Copping, Mr. and Mrs. Foote Waugh, Mrs. John Barran, Mr. and Mrs. Jack Bayne, Mr. Alister Muir, Mr. and Mrs. S.F. Bradley, Dr. Wm. Bird, Mrs. Bruce Cleig, Mr. Brock MacDonald, Miss R. Ross, Mrs. Eckel, Miss Gwen Wright, Mr. John G. Sarles, Miss Sheila Buchan, Miss Verna Newson, Mr. Norman Precious, Miss Betty Wise, Dr. D.M. Whitelaw, Miss Heather Leveson-Gower, Mr. Frank Sandford, Mr. Bill Merrilees, Mr. William M. Hughes (compiler), Dr. J. Ross McKay, Mr. Ian MacGregor (Vancouver Natural History Society).

Vernon, B.C. (West to Okanagan Landing, north to Buckerfield's Ranch, south to Kalomalka Lake, and east to Coldstream Ranch). — Dec. 23, 1956; 8.45 a.m. to 3.30 p.m.; temp. 18° to 30°; overcast; snowing 10.30 a.m. to 1.00 p.m.; wind light; snow depth, 2 to 8 in.; Okanagan and Kalomalka Lakes clear of ice, Swan Lake frozen over; 8 full-time and

11 part-time observers in 4 parties. Total observer hours, 82.

Horned Grebe, 5; Western Grebe, 3; Great Blue Heron, 1; Mallard, 119; Green-winged Teal, 25; Baldpate, 39; Redhead, 4; Ring-necked Duck, 1; Lesser Scaup, 13; Greater Scaup, 4; Common Golden-eye, 4; Barrow Golden-eye, 5; Buffle-head, 3; Am. Merganser, 3; Cooper's Hawk, 1; Pigeon Hawk, 1; Sparrow Hawk, 7; European Partridge, 10; Pheasant, 85; California Quail, 7; Am. Coot, 276; Virginia Rail, 1; Killdeer, 1; Wilson's Snipe, 8; Herring Gull, 3; Mourning Dove, 2; Pygmy Owl, 3; Hawk Owl, 1; Belted Kingfisher, 2; Red-shafted Flicker, 40; Pileated Woodpecker, 1; Hairy Woodpecker, 4; Downy Woodpecker, 3; Steller Jay, 9; Magpie, 62; Raven, 4; Crow, 308; Clark's Nutcracker, 3; Black-capped Chickadee, 48; Mountain Chickadee, 5; Red-breasted Nuthatch, 1; White-breasted Nuthatch, 1; Dipper, 3; Robin, 356; Townsend Solitaire, 1; Golden-crowned Kinglet, 6; Bohemian Waxwing, 403; Northern Shrike, 9; Common Starling, 26; House Sparrow, 190; Meadowlark, 3; Red-winged Blackbird, 18; Evening Grosbeak, 360; Pine Grosbeak, 15; Cassin's Finch, 7; Am. Goldfinch, 48; Common Redpoll, 58; Oregon Junco, 455; Tree Sparrow, 1; White-crowned Sparrow, 6; Song Sparrow, 25. Total, 61 species; 3,116 individuals.

—Miss K. Bartholomew, J.B. Beddome, A. Brown, Mr. and Mrs. S. Condrashoff, Mrs. K. Dobson, Miss T. Gabriel, J. Grant, J. Holms, H. Murton, J. Obana, D. Quirk, J. Quirk, Miss B. Ross, D.A. Ross, Miss S. Ross, D.H. Ruppell, B.A. Sugden, P. Tassie (The North Okanagan Naturalists' Club).

Victoria, B.C. (Sea coast, rocks and beaches, woodland, fields, flooded areas, country roads, city park). —Dec. 29, 1956, 8.30 a.m. to 4.00 p.m.; temp. 40°; wind imperceptible. 17 observers in 7 parties. Total party hours, 37 (25 on foot, 12 by car); total party miles, 48 (14 on foot, 34 by car).

Common Loon, 41; Arctic Loon, 1; Red-necked Grebe, 10; Horned Grebe, 162; Eared Grebe, 57; Western Grebe, 112; Double-crested Cormorant, 6; Pelagic Cormorant, 221; Great Blue Heron, 4; Mute Swan, 3; Canada Goose, 24; Brant, 4; Mallard, 1551; Pintail, 390; Green-winged Teal, 223; European Widgeon, 2; Am. Widgeon, 2696; Shoveler, 197; Mandarin, 2; Wood Duck, 2; Ring-necked Duck, 6; Canvas-back, 26; Greater Scaup, 947; Lesser Scaup, 6; Am. Golden-eye, 100; Buffle-head, 318; Old-squaw, 50; Harlequin Duck, 63; White-winged Scoter, 207; Surf Scoter, 139; Ruddy Duck, 77; Hooded Merganser, 36; American Merganser, 78; Red-breasted Merganser, 37; Goshawk, 3; Sharp-shinned Hawk, 3; Cooper's Hawk, 3; Bald Eagle, 1; Pigeon Hawk, 1; Peregrine Falcon, 2; California Quail, 15; Ring-necked Pheasant, 13; Am. Coot, 318; Killdeer, 25; Ruddy Turnstone, 1; Black Turnstone, 86; Wilson's Snipe, 35; Hudsonian Curlew, 2; Greater Yellow-legs, 3; Aleutian Sandpiper, 20; Red-backed Sandpiper, 2; Glaucous-winged Gull, 749; Herring Gull, 23; Short-billed Gull, 458; Pigeon Guillemot, 12; Marbled Murrelet, 1; Belted Kingfisher, 6; Red-shafted Flicker, 84; Hairy Woodpecker, 2; Downy Woodpecker, 5; Skylark, 38; Horned Lark, 7; Common Raven, 3; Northwestern Crow, 319; Chestnut-backed Chickadee, 107; Bush-tit, 28; Red-breasted Nuthatch, 7; Brown Creeper, 12; Winter Wren, 12; Bewick's Wren, 22; Am. Robin, 196; Varied Thrush, 23; Hermit Thrush, 2; Golden-crowned Kinglet, 86; Ruby-crowned Kinglet, 6; Water Pipit, 40; Cedar Waxwing, 24; Northern Shrike, 1; Common Starling, 5; Audubon's Warbler, 1; House Sparrow, 230; Western Meadowlark, 44; Brewer's Blackbird, 210; Purple Finch, 58; House Finch, 126; Spotted Towhee, 26; Oregon Junco, 215; White-crowned Sparrow, 3; Golden-crowned Sparrow, 32; Fox Sparrow, 21; Song Sparrow, 60. Total, 92 species; 11,639 individuals.

—Mr. J.O. Clay (leader), Mrs. H.W.S. Soulsby, Mrs. H.M.S. Bell, Mr. R. Beckett, Mr. P. Symons, Mrs. G.J. Jackson, Miss E.K. Lemon, Mr. Alan Poynter, Mr. and Mrs. P.M. Monckton, Mrs. E. McGavin, A.R. Davidson, Miss Leila Roberts, Miss M.C. Melburn, Mrs. W.L. Taylor, Mrs. Sherman, Mr. W. Adams.

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REPORT OF COUNCIL AT THE SEVENTY-EIGHTH ANNUAL MEETING OF THE OTTAWA FIELD-NATURALISTS' CLUB, DECEMBER 6, 1956

Since the last Annual Meeting, there were six meetings of Council, all at St. Patrick's College: December 14, 1955, with 17 members present; February 29, 1956, with 17 members present; April 13, 1956, with 20 members present; May 4, 1956, with 22 members present; October 15, 1956, with 12 members presend; and November 12, 1956, with 13 members present.

Appointments were made for 1956 as follows:

Editor of The Canadian Field-Naturalist — Mr. R. A. Hamilton

Business Manager of the Canadian Field-Naturalist — Mr. W. J. Cody

Chairman of the Publications Committee — Dr. J. W. Groves

Chairman of the Excursions and Lectures Committee — Mr. P. A. Ruddell

Chairman of the Reserve Fund Committee — Mr. Hoyes Lloyd

Chairman of the Special Lectures Committee — Dr. L. S. Russell

Chairman of the Membership Committee — Mr. W. J. Cody

Chairman of the Bird Census Committee — Dr. D. B. O. Savile

Chairman of the Macoun Field Club Committee — Dr. E. L. Bousfield

Representatives, Canadian Section, International Committee for Bird Preservation — Mr. W. E. Godfrey and Dr. D. A. Munro

REPORT OF THE PUBLICATIONS COMMITTEE

During the period December 1, 1955, to December 1, 1956, two numbers of Volume 69 of The Canadian Field-Naturalist were published, with a total of 103 pages. Papers, notes and reviews were distributed as follows:

	Papers	Notes	Reviews
Botany	5	2	1
Entomology	—	—	1
Ichthyology	1	—	—
Invertebrate Zoology	1	2	—
Mammalogy	2	—	1
Ornithology	4	8	2
Miscellaneous	4	—	3

Nine maps and figures were used. Sales of single and back numbers totaled $374.60.

REPORT OF THE EXCURSIONS AND LECTURES COMMITTEE

Business dealt with by the committee during the year included arrangement of a program of outings, production of the Newsletter, the management of the Study Groups, arrangement of the Annual Dinner, and finances of the committee.

There were two all-day excursions. The first was to the Pakenham and Almonte district, highlighted by a visit to the Mill of Kintail. The second was to the Club lodge at Crystal Bay. A Members Night was held in November at the Ottawa Teachers' College. Illustrated talks were given by members. The Annual Spring Dinner was held in April at the Experimental Farm. Ably arranged by Miss Mary E. Stuart, the dinner was a great success, 131 members and friends being present. The guest speaker was Mr. W. W. Mair of the Canadian Wildlife Service.

Because of the increased cost of producing the Newsletter, only one issue has so far been produced in 1956. Displays were made at most of the Audubon Screen Tours, in order to advertise the Club and promote local membership.

An interesting program of Bird Walks was arranged by Mr. A. E. Bourguignon in the spring. Five early morning Bird Walks started from Bronson Bridge, one on each Tuesday morning in May. These were under the leadership of Mr. A. E. Bourguignon, Mrs. D.B.O. Savile, Mr. Earl Godfrey, Mr. Eric Mills, and Mr. Rowley Frith, respectively.

REPORT OF THE RESERVE FUND COMMITTEE

The only change reported for the year was the purchase by the Treasurer, upon authorization by the Committee, of one additional share of Bell Telephone stock at $37.00 and the selling of two rights at $1.96.

REPORT OF THE SPECIAL LECTURES COMMITTEE

Three Audubon Screen Tours completed the 1955-56 series:

January 3 — Animals at Night in Color, by Howard Cleaves.

March 26 — Hawaii, U.S.A., by Fran William Hall.

April 17 — Penguin Summer, by Olin Sewall Pettingill.

The following lectures of the ninth season complete the program for 1956:

October 18 — American Birds and Big Game, by Cleveland P. Grant.

November 22 — Between the Tides, by Robert C. Hermes.

REPORT OF THE MEMBERSHIP COMMITTEE

The Committee did not feel it advisable to conduct an active campaign for increased membership in view of the present lag in publication of The Canadian Field-Naturalist.

REPORT OF THE BIRD CENSUS COMMITTEE

A very successful Christmas Bird Census was reported, 6263 individual birds being counted, representing 34 species. Results of the Christmas Bird Census in the Ottawa District and for all of Canada will be published in a forthcoming issue of The Canadian Field-Naturalist. [Editor's note: See page 17 of this issue.]

REPORT OF THE MACOUN FIELD CLUB COMMITTEE

During 1956 the Macoun Field Club completed its eighth year of activity. As in previous years, the meetings were held at weekly intervals in the National Museum; the Senior (High School) Group on Tuesdays after school, and the Intermediate (Grades 7 and 8) and Junior (Grades 5 and 6) Groups at different hours on Saturday morning. The Senior Group numbered 20 active members under the chairmanship of Paul Goulet and a committee of four. The Intermediate Group of 22 and the Junior Group of 27 were headed by Ian McLaren and John Scoggan, respectively.

The program for all three groups included 21 regular meetings, of which seven were field trips to the O.F.-N. Lodge at Beattie Point, Wills' Quarry, White's Bridge, Mer Bleue, and other nature trails around Ottawa. The Club is much indebted to members of the O.F.-N. Club, the staff of the National Museum, and many interested persons who gave talks, conducted the meetings, and provided leadership and transportation on the field trips. At the eighth annual Birthday Party, held in the Museum on April 21, badges were presented to 17 new members and prizes were donated to the Junior and Intermediate winners of the attendance and merit game. These and other successful contestants were treated to a special party held in May at the home of the chairman.

Once again Club members participated actively in television, this time on CBOT's "Museum Quiz" held every Tuesday afternoon at 5.00 p.m. during October and November. Selected members helped with short radio broadcasts on April 13 (CFRA) and April 24 (CBO). Other activities included the publication of two issues of "The Little Bear" (Numbers 11 and 12) edited by Mr. Herbert Groh and illustrated by Paul Goulet, and the providing of ushers, under the direction of Henriette Hawksbridge, for the Audubon Screen Tour series at Glebe Collegiate. Exhibits of collections and hobbies of the members were displayed at the annual banquet of the O. F.-N. Club in April, and on other occasions. The Club continues to receive letters and gifts from interested friends and former members, all of which are gratefully acknowledged and appreciated.

REPORT OF THE SPECIAL COMMITTEE ON INCOME TAX DEDUCTIONS

At the council meeting of April 13, Mr. Hoyes Lloyd accepted the request of Council to approach officials of the Taxation Division of the Department of National Revenue with the suggestion that the work of the Club was of such a nature as to make eligible for income tax deductions donations to the Club over and above the regular membership fee. Aided by Mr. A.E. Bourguignon, Mr. Lloyd pursued this matter both by personal contact and by correspondence, pointing out many reasons why it was felt that the Club should rank as a charitable organization for purposes of such income tax deductions. At the council meeting of October 15, however, it was reported that this application had been refused, and, upon request of Mr. Lloyd, the Committee was discharged of its duties.

NOTICES OF MOTION

Notice of Motion having been given at the Council Meeting of February 29, it was moved and carried at the meeting of April 13 that the words "AND THE PUBLICATION FUND" be added to Bylaw 7, this to read: "The Reserve Fund Committee shall serve in an advisory capacity to the Treasurer in the matter of investment of the Reserve Fund and the Publication Fund."

Notice of Motion having been given at the Council Meeting of April 13, it was moved and carried at the meeting of May 4 that an addition be made to the Bylaws indicating that the Officers of the Club be named Directors, in addition to the President, who is automatically one, namely the First and Second Vice-Presidents, Secretary, Treasurer, Editor, and Business Manager.

W. K. W. Baldwin
President

H. J. Scoggan
Secretary

NOTES

Wintering of Red-headed Woodpecker in Manitoba

During two winters I spent in St. Vital, Winnipeg, a Red-headed Woodpecker *Melanerpes erythrocephalus* (Linnaeus) also spent the winter there. As the Red-headed Woodpecker is far from common in the area in the summer, wintering is quite exceptional. The wintering was observed during the period 1937-1939. Mr. B. W. Cartwright informs me that the species is now, in 1955, an even scarcer summer visitor in the district than it was in the '30's. The following notes may therefore be of some interest as it appears that the wintering of this woodpecker in Manitoba is likely to remain a very rare event.

When I arrived in St. Vital in the latter part of October 1937, the Red-headed Woodpecker was already there and stayed throughout the winter. The minimum temperature during that winter was — 41°F. On April 10, 1938, for the first time two birds were seen, a second presumably having arrived on migration. I returned again to St. Vital on December 10, 1938, and found the bird was wintering again. It was seen up to March 21, 1939, after which it was not seen for over a month.

The following notes refer to its 1938-1939 winter behavior. The minimum temperature during this winter was —38°F. A bird table was put up during this second winter and the bird came regularly. It spent much time carrying off food which it deposited in crevices mainly in an old tree trunk. It also spent some time resting on the table. A roosting box was also put up for this bird during its second winter. It took an interest in this box but did not roost in it, apparently having a better roost in a hollow pole outside the observation area. The bird appeared at home in the snow and on one occasion was observed (at close quarters) to "wash" down its food with snow which it scooped up with its bill. It called moderately freely in December and January but it was noticed that it did so less in February. This suggested that the bird was not maintaining its bodily condition. On March 21 it was noted that the bird's breast was beginning to look rather soiled, another sign of loss of condition. It was never heard to give spring notes.

The bird normally appeared in the area of observation between 10 and 11 a.m., but was seen at 9 o'clock in the morning of December 24 and did not appear until 1 p.m. in a watch on February 12. Three all-day watches were made to find out how much time it spent in and about the area of observation, where it both fed and rested. This area was very restricted for a wintering woodpecker and was in the region of half an acre. The area contained, besides the bird table and bird box, five other favorite perching places, two poles and three trees. The results of the all-day watches were as follows: January 20 (Ref. No. D.136), maximum temperature 26°F, minimum —15°F; day length from sunrise to sunset 8 hours 46 minutes. The bird arrived in the restricted area at 9.41 a.m. and left for the day at 1.21 p.m., giving an in-area day of 3 hours 40 minutes. January 21 (Ref. No. D.137), maximum temperature 21°F, minimum —16°F; day length 8 hours 48 minutes. The figures were: arrival 9.30 a.m., final departure 11.20 a.m., in-area day 1 hour 50 minutes. Up to this date this was one of the stormiest days of the winter, with a high wind driving powdery snow. February 12 (Ref. No. D.138), maximum temperature 13°F, minimum —17°F; day length 9 hours 54 minutes. The bird did not arrive until 1.02 p.m. and departed for the day at 4.27 p.m. giving an in-area day of 3 hours 25 minutes. When it left it was seen going towards its roost.

In conclusion it may be said that the bird, having found a good feeding and resting area in the vicinity of the bird table, was content to remain a considerable portion of its day in this very restricted area. It retained its old roost outside this area. The bird table was not, however, the prime cause of its spending the winter, as it had already spent the 1937-1938 winter without the table and was already present during the 1938-1939 winter before the table was put up. There were indications (reduction of calling, soiled plumage) that the bird was failing to maintain its full bodily condition under the severe winter conditions.

All times given above are in local apparent time, the time by the sun at the place of observation. I am indebted to the Winnipeg Free Press for the temperature readings.

NOBLE ROLLIN

World Bird Research Station
Glanton, Northumberland
England

Some Recent Ottawa Bird Records

The following notes include observations of scarce or unrecorded species of birds in the Ottawa district in recent years. Systematic fall observations in the last ten years have altered the local apparent status of various species, notably some shore birds, but these data can well be left for incorporation into the next revision of the district list.

GADWALL *(Anas strepera)*. A male in Dow's Lake and the waterfowl enclosure 8-19 Nov. 1949; a male 19 Apr. 1950, a female 18 Oct. 1951, and a bird of doubtful sex 14 Aug. 1952, all in the same area. On 2 Nov. 1952 two males were seen in extremely poor light in Shirley Bay by Mrs. Savile, Capt. T.F.T. Morland and myself, and females were suspected to be present. Females, young and eclipsed males may easily be overlooked among Black Ducks in difficult light, and the species should perhaps be considered scarce rather than accidental.

BARROW'S GOLDEN-EYE *(Bucephala islandica)*. After several years' scrupulous checking of golden-eyes, Mrs. Savile and I saw a male off Beattie's point, Lake Deschênes, on 31 Oct. 1954, in company with several American Golden-eye. It was distinguished through glasses by the checkered rather than solid white flank; and a ×20 telescope showed the distinctive head shape and face patch.

TURKEY VULTURE *(Carthartes aura)*. On 1 June 1952, Mrs. Savile, Capt. Morland and I emerged from a thicket near Uplands airport, in response to a commotion by crows, to find a Turkey Vulture circling southeastward down wind. It may have come north the previous day on a southeast wind. Apparently our local crows are unaccustomed to this species in either their summer or their winter range, for crows do not ordinarily molest it in areas where it is common. Bagg and Parker (Auk 68:328, 1951) include one record of the Turkey Vulture from about 50 miles north of Ottawa, but this seems to be the first sighting actually within the Ottawa district.

STILT SANDPIPER *(Micropalama himantopus)*. Additional records are 10 Sept. 1950, near Beattie's Point, and 26 Sept. 1953, Graham's Bay.

WESTERN SANDPIPER *(Ereunetes mauri)*. One studied closely at Graham's Bay, 15 Oct. 1950, by Mrs. Savile, Capt. Morland and myself. The size, general appearance and feeding habits agreed closely with those of the Semi-palmated Sandpiper; but the bill, betwen 1⅛ and 1¼ times the length of the head and much more slender than that of the substantially larger juvenile Red-backed Sandpiper, made determination positive. The species may come through Ottawa in appreciable numbers, although less frequently than through the Great Lakes, but only birds with pronouncedly long bills would be distinguishable in the field.

ICELAND GULL *(Larus leucopterus)*. First or second year birds have been seen, mostly on Dow's Lake, on 22 Nov. 1949, 20 Nov. to 12 Dec. 1951, 17 May to 3 June 1952, 4 Dec. 1953, 27 Dec. 1954. Lacking specimens and adult records, it is questionable whether local transients are predominantly *L. l. leucopterus* or *L. l. kumlieni*. My limited observations suggest that the species is as abundant locally as the Glaucous Gull.

GREAT BLACK-BACKED GULL *(Larus marinus)*. Additional records include: 29 Oct. 1948; 13 Sept., 23 Oct. and 22-23 Nov. 1950; 16 and 22 Nov. 1952; 3 Jan., 6 Nov. and 3 Dec. 1953. The early fall records are of first- and second-year birds; the late fall and winter records are mostly of third-year birds and adults.

THAYER'S HERRING GULL *(Larus argentatus thayeri)*. On 9 Oct. 1951 an adult gull with lighter wing tips than those of accompanying *L. a. smithsonianus* was seen on the log boom in Dow's Lake. After some minutes it flew, passing within fifty yards of me, and the wing tips were seen to have no black but a small area of darker gray than the mantle. The mirrors seemed to be large but not confluent. The dark gray tips and intact mirrors seem to rule out the possibility of Kumlien's Gull.

ARCTIC TERN *(Sterna paradisaea).* On 8 June 1952 Mrs. Savile and I were astonished to see eight Arctic Terns in breeding plumage at the foot of Deschênes Rapids near Britannia. They were first recognized by the grayish cast of the breast in contrast with the white of the cheek and of the upper and lower tail coverts — an excellent field mark under a variety of lighting conditions. Eventually all came close enough for the fully red bill (seen only in late summer in the Common Tern and then a different shade) to be clear; and two settled on a log, allowing the short tarsus to be seen. A cold-front passage over James Bay on the night of 6-7 June, with a subesquent north wind, is thought to have brought these southbound migrants overland by morning, whence they presumably drifted down wind to Ottawa. (See Amer. Midl. Nat. 56: 444, 1956.)

BRUNNICH'S MURRE *(Uria lomvia lomvia).* The latest local flight of this species, in mid-December 1952, was preceded, all the way from the Gulf of St. Lawrence to west of Ottawa, by several days of light but sustained easterly winds. It is suspected that these birds were brought overland by an undetected wind shift at night and, finding themselves inland, wandered down wind.

WHITE-EYED VIREO *(Vireo griseus).* In addition to the specimen of 1947 recorded by Lloyd (Can. Field Nat. 63:34, 1949), there are two sight records. On 14 May 1946 one was seen in the Arboretum on a morning bird walk by, among others, A.L. Rand, G. Cooch, J. W. Groves and myself. Dr. Groves and I saw it again later in the day, and on the next day we both saw it low down and at very close range, amply confirming its identity. On 14 May 1955 Mrs. Savile and I had a close and prolonged view of one in Dow's Swamp during a migration of Blue-headed Vireos.

WESTERN MEADOWLARK *(Sturnella neglecta).* On 30 Apr. 1954, one sang about twenty times from various trees in the Arboretum before disappearing in the direction of Hartwell's locks. This is possibly the bird that was observed during the summers of 1954 and 1955 near Cyrville by Mr. Frank Munro.

GRASSHOPPER SPARROW *(Ammodramus savannarum).* With the expansion of Uplands airport the colony that Dr. O.H. Hewitt found on the western edge of the airport (in 1947) has been displaced to sloping land on the southern limits, where it has ample, presumably permanent, rough grassland. The colony was substantial in 1952, and several birds were found singing there in 1954 and 1955. In 1952 Capt. Morland, Mrs. Savile and I found a pair near City View and two singing birds southwest of Carlsbad Springs; but cultivation has apparently prevented permanent colonization of these sites.

D. B. O. SAVILE

Science Service Building, Ottawa, Ontario

Late Spring Occurrence of the Evening Grosbeak in Northern Lincoln County, Ontario

It has been noted for a long time that the Evening Grosbeak *Hesperiphona vespertina* (Cooper) is more commonly seen in May than at any other time of the year along the Lake Ontario shore of Lincoln County from Grimsby to Vineland Station. Most of the observations were at the Horticultural Experiment Station at Vineland Station; all were within a few hundred yards of the lake. During the 16 years from 1940 to 1955 inclusive the number of years, and (in parentheses) the total number of days, in each month when one or more birds were seen were as follows: October, 1 (1); November, 4 (4); December, 3 (4); January, February, and March, none; April, 1 (2); May, 6 (24). In the last month they were seen in 1940, 1946, 1947, 1950, 1951, and 1955; they were fairly evenly distributed from May 1 to 20. The greatest number of May occurrences in any one year was seven, in 1946. All of the birds seen in this month were solitary except a single pair. It is possible that a single bird staying in the vicinity was sometimes responsible for more than one record, but that was certainly not always true because birds seen on consecutive days were often of different sexes.

It is true that the May records may be somewhat biased owing to the greater time spent outdoors, but there can be no doubt that Evening Grosbeaks are actually most prevalent in that month.

A few of the Grosbeaks were seen feeding on the ground but most of them flew restlessly from tree-top to tree-top, calling loudly and persistently and suggesting birds that were lost. They were probably late migrants that hesitated to cross the lake and wandered along the shore.

WILLIAM L. PUTMAN
Vineland Station, Ontario

Western Kingbird in Alberta

The known range of the Western Kingbird *Tyrannus verticalis* has been greatly extended northward in Alberta over the past few years. It is now known to occur commonly, where suitable habitat is found, south of a line running northeast from Calgary to Provost, and odd records have been made for points well to the north of this line. We were, however, surprised to find a single bird of this species on May 31, 1956, near the village of Lac Ste. Anne, some 45 miles northwest of Edmonton. The bird was perched on a telephone wire when first seen, and was examined at close range for ten minutes while it made occasional forays over the willows which border both the lake and the road at that point. An Eastern Kingbird *Tyrannus tyrannus* was engaged in similar activities fifty yards down the road. This record we believe to be the most northerly one for *Tyrannus verticalis* in Alberta.

REGINALD HEATH and ROBERT LISTER
Edmonton Bird Club
Edmonton, Alberta

Bewick Wren Utilizing the Same Nest for a Second Brood

A Bewick Wren *Thryomanes bewickii calophonus* nested on a shelf in my garage at Comox, B.C., and the young flew on May 9, 1955. I cannot say when the bird commenced laying the second set of eggs but I banded four of the nestlings on July 5 and they were then old enough to make it difficult to keep them in the nest. They would certainly have flown by the 9th or two months after the first brood left the nest.

One hears of birds using the same nesting site twice in the same year but making use of the same nest must be unusual; it was not a case of shortage of nesting sites as there were plenty within the garage or near by.

Examination of the nest showed that a second lining had been added. It was the usual bulky structure, occupying some 14 in. of the two-by-four. It had a depth of four inches and consisted of dead weed stems, grass, straw, leaves, and slivers of wood from the adjoining wood shed. It is puzzling to see how the bird could have managed the carrying of some of the material to the nest; the largest sliver was five inches long by three eights of an inch broad with a thickness of one sixteenth inch, and many of the other items were several inches long. The lining was of fine roots, a few feathers, and one or two pieces of cotton wool and straw. The second lining seemed to be of similar material.

THEED PEARSE
Comox, British Columbia

Recent Bird Observations in the Calgary District

CINNAMON TEAL *Anas cyanoptera*

The Cinnamon Teal is of sufficiently rare occurrence in the Province of Alberta that the writer considers the following observations in the spring of 1956 to be noteworthy. On the morning of May 24, the writer, in company with R. Lister of the Department of Zoology, University of Alberta, flushed a male Cinnamon Teal from one of a series of tree-bordered potholes on the prairie approximately five miles north of Calgary. This bird was flushed successively from the same and other of the potholes, three times or more, and excellent views were obtained of the bird both in flight and on the water. Shortly afterward, this time with C. Molony of Toronto, I found a pair of this species on a large slough one mile east of where the first bird had been seen.

BOBOLINK *Dolichonyx oryzivorus*

On May 21, 1956, a single male Bobolink was seen by the writer and R. Lister; it was singing from a fence post about three miles south of the city. On May 21, two males and a female were observed in the same area, and on June 3 four males were present. On July 1, the writer with A. Schultz found a total of four pairs, and we were able to locate one nest which contained five young, four of which were dead from some unknown cause, probably a severe hail storm in the area two days before. The one living nestling was in a very weakened condition; it was taken by Schultz in the hope of hand-rearing it, but died on the following day.

GRASSHOPPER SPARROW *Ammodramus savannarum*

The Western Grasshopper Sparrow is listed in A. L. Rand's *Birds of Southern Alberta* as a scarce summer resident in the extreme southeastern portion of the province. On the morning of May 21, 1956, the writer, with Miss Margaret Cope, heard and later observed a male Grasshopper Sparrow singing in a roadside area of long dense grass, three miles south of Calgary. On the following morning I, accompanied by R. Lister, visited the area and watched the bird through a 20× spotting scope, in excellent light, for periods as long as five minutes at a time. It was singing from the tops of tall grass stems. The flat-headed appearance, the plain buffy breast, with the absence of streaking of any kind, were carefully noted, and these characteristics distinguished it from the Leconte's Sparrow, the only other bird in the Calgary area with which it might be readily confused. The writer is well acquainted with the Grasshopper Sparrow, having observed it on numerous occasions in the Toronto area and southern Ontario over the past twenty years. This appears to be the first record for this species for the Calgary district.

E. D. BEACHAM

324 42nd Street, S.W.
Calgary, Alberta

A Breeding Record for the Wood Duck in Alberta

On the morning of May 20, 1956, the writer and Miss Margaret Cope observed a male and female Wood Duck *Aix sponsa* on a small semistagnant backwater of Fish Creek, on the P. Burn's Bow Valley Ranch at Midnapore, Alberta, five miles south of Calgary. On the evening of June 26 Miss Cope reported that she had observed a female of this species with four downy young at the same locality. On the morning of June 27 the writer with B. McKay and A. Barber visited the area and again found the female, this time accompanied by five young. We were fortunate in being able to trap all five young, which were photographed. Four were banded and released, the fifth was collected and turned over to Mr. O. D. Boggs for preparation as a specimen which has been donated to the Department of Zoology, University of Alberta, at Edmonton. This is believed to be the first recorded breeding of the Wood Duck in the Province of Alberta.

E. D. BEACHAM

324 42nd Street, S.W.
Calgary, Alberta

A Red Bat from New Brunswick

On October 24, 1955, a bat was brought to the Department of Biology at the University of New Brunswick by Dr. D. F. V. Brunsdon, of the New Brunswick Department of Health. The bat had been captured some days previously by Mr. Fred Gallop of Springhill, New Brunswick, in a shack near a fire tower in the vicinity of Long Lake, Tobique Valley. The animal was alive and torpid. It was subsequently returned to Mr. Gallop, who released it where it had been found.

The bat was identified by the writer as a red bat *(Lasiurus borealis)*. Only one other provincial specimen is known, that in the collection of John Moses of Grand Manan (Copeland and Church, 1906). Chamberlain in 1884 described it as rare in the Province.

Two Nova Scotia records are known, one from off Cape Sable (Norton, 1930) and another off Liverpool (Brown, 1953). They have been taken from Mt. Desert Isle in Maine (Manville, 1942), are said to be common in southern Quebec (Anderson, 1939), and are known from several localities in Vermont (Osgood, 1938). The new Brunswick record appears, then, to mark an extension of the known northern limit for the red bat in the east.

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EDWIN M. HAGMEIER

Department of Biology
University of New Brunswick
Fredericton, New Brunswick

Cardinals in Montreal

In January 1956 a male Cardinal *Richmondena cardinalis* was seen in Mount Royal cemetery by several of the employees. The Province of Quebec Society for the Protection of Birds was informed and three members, J. W. Robinson, John Delafield and Mrs. H. E. Chalk, saw this Cardinal on Feb. 26.

On March 8 a male Cardinal appeared at the feeding station of H. A. C. Jackson of Montreal West. This bird appeared for thirty-five consecutive days. It was seen by many observers at close range from a porch and was photographed. It was fed, for the most part, sunflower seeds. It seemed unlikely that this bird was the same individual as the one on Mount Royal as the distance between the two locations is some 8 miles.

On May 17 the author, while visiting Mount Royal cemetery, met one of the gardeners, Mr. Paquette, who was among the first to see the Cardinal in January. His observation of the bird again on April 11 presents conclusive evidence that there had been two Cardinals in the Montreal district.

Thinking that it might prove to be a record for Montreal, the author got in touch with W. Earl Godfrey, Curator of Birds, National Museum of Canada, Ottawa, who wrote that there is at least one previous record. This was published by J. F. Whiteaves (Canadian Naturalist 5: 103, 1870) whose comments are as follows: "In the early part of January 1862, Mr. W. Hunter saw two individuals of this species on the Montreal mountain, one of which is now in his possession."

HENRY A. C. JACKSON

35 Campbell Avenue
Montreal West, Quebec

Crayfish Stranded in Winter on the Bank of Medway Creek, London, Ont.

On March 14, 1956, a concentrated assemblage of dead crayfish was found in a roughly triangular area about 150 feet long on the west bank of Medway Creek, London, Ontario, where the Creek passes through the property of a golf club. The area was bounded on the north by a circular golfing green about 100 feet wide, on the west by a sand dune about 300 feet long and on the east by the top of the creek bank which sloped downward five feet to the water and was overgrown with small willow saplings. At the time, the watercourse of the creek was about 50 feet wide.

The great majority of the crayfish were upright on the sand and were facing west. A few had burrowed backward into the sand so that their abdomens were buried and some were upside down or lying on their sides. The greatest concentrations were found in hollows around the bases of trees and huddled against the east border of the sand dune. Enough crayfish were collected to fill a six-quart basket, 1077 specimens altogether, and many more were left lying on the ground. During the collecting two larvae of the Dobson fly *Corydalus cornutus* and a few dragonfly nymphs were found among the crayfish. Fifty intact crayfish were identified with keys in Huntsman (1915) and Pennak (1953) and proved to be *Cambarus bartoni robustus* Girard (2 males), and *Orconectes propinquus* (Girard) (33 males, 15 females). These two species are reported by Huntsman and Pennak to be found in the Great Lakes drainage, especially in streams with stony bottoms. The largest specimen collected was one of *C. bartoni robustus*, with a length of 9 cm. from the tip of the rostrum to the tip of the telson, and the smallest specimens were about 2.5 cm. long.

The cause of the assemblage of crayfish was doubtless a flood that occurred during March 7 to 9 and which inundated wide areas adjacent to the banks of the Thames River and its tributaries, including Medway Creek. During this period the flood water, sweeping around a curve in the Creek, had gouged out an excavation in the east bank, just below a foot bridge, and had then swept across and deposited the long sand dune on the golf course at the edge of the creek. Crayfish and other creatures, scoured from the stony bottom of the Creek, were deposited on the bank, and as the water receded, were left stranded. Most of them huddled in pools around the bases of the trees and along the margin of the sand dune and were frozen or desiccated with the return of cold, dry weather.

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W. W. JUDD

Department of Zoology
University of Western Ontario
London, Ontario

Northward Extension in Recent Years of the Range of the Lettered Sphinx Moth [1]

The lettered sphinx moth *Deidamia inscripta* (Harris) was recorded by Holland in his "Moth Book" as something of a rarity in the Middle Eastern States. Subsequent collectors have found the species not uncommon in that region; I myself took a considerable series at Ithaca, N.Y., in 1946. The species has evidently been a regular inhabitant of the Upper Austral Zone, no doubt including the part that lies in Ontario, for as long as insects have been collected there.

Until 1947, however, the lettered sphinx does not appear to have been known in the Ottawa or St. Lawrence valleys. In that year I collected a specimen at Ste. Anne de Bellevue, Que.; Prof. P. H. H. Gray has subsequently collected two or three specimens at his home in the adjacent community of Baie d'Urfé. In 1949, Dr. D. F. Hardwick took a specimen in a light trap at Ottawa, Ont.; additional specimens were taken at Ottawa by Mr. G. E. Shewell and by myself in 1954. In May and June of this year, five specimens have so far been taken in the Ottawa area: three in a light trap operated at Bells Corners, Ont., one at Ottawa by Mr. J. E. H. Martin and one at Manotick, Ont., by Dr. T. N. Freeman.

This species does not appear in Winn's Province of Quebec List. There are no specimens taken in this region earlier than 1947 in the Canadian National Collection or in any Quebec collection with which I am familiar. When it is considered on the one hand that the species was not found in about 70 years of intensive collecting by a number of entomologists in Quebec, or in about 50 years of collecting by a small but active group in the Ottawa region, and on the other hand that it has been taken repeatedly in somewhat sporadic collecting in the Montreal and Ottawa districts in the last ten years, there seems little doubt that the lettered sphinx has recently moved northward into our region and that it has become established here.

EUGENE MUNROE

Insect Systematics and
Biological Control Unit
Entomology Division
Canada Department of Agriculture
Ottawa, Ontario

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[1] Contribution No. 3468, Entomology Division, Science Service, Department of Agriculture, Ottawa, Canada.

Received for publication October 12, 1956

The Parasitic Jaeger in Saskatchewan

On June 27, 1956, the writer, in company with Douglas Stephens, Wesley Schmidt, R. D. Harris, and Ron Lamont, all of the Canadian Wildlife Service, was investigating waterfowl on a lake about one square mile in area, 1½ miles west of Inglewood, and 9 miles south and 1½ miles west of Kindersley, Saskatchewan.

Approaching this lake (called Losinsky's Slough), we saw a single Parasitic Jaeger *Stercorarius parasiticus* flying in a flock of Ring-billed Gulls. It flew within 20 yards and allowed positive identification.

The gulls were coming from an island about 2½ to 3 acres in area, located in the east-central part of the lake, where there was a sizable nesting colony. Quite possibly the jaeger had been visiting this island to parasitize the adult gulls or prey on the young.

Stephens, Schmidt, Lamont, Alex Dzubin, and J. Bernard Gollop (the latter two also of the Canadian Wildlife Service), stated that they had not seen the species before in that area though they had all visited the island several times and two of them had visited the area in past years.

W. Earl Godfrey, Curator of Birds at the National Museum of Canada, (in a letter) states that "according to a letter written by F. Bradshaw to P. A. Taverner on September 25, 1933, a Parasitic Jaeger was taken by G. H. Lydiard at Lake Johnstone, Saskatchewan, September 19, 1933, where it was apparently found dead."

Two additional records of this bird in Saskatchewan were kindly furnished by Fred G. Bard, Director of the Saskatchewan Museum of Natural History. These were "one suffering from botulism on Old Wives Lake, taken September 1, 1933, by George Lydiard" and a specimen shot "by Mr. Vinn Huggins, October 28, 1933, at Imperial Beach, east of Imperial, Saskatchewan."

According to P. A. Taverner (in Birds of Western Canada, Nat. Mus. Bull. No. 41, Ottawa, 1928), this is the jaeger most likely to be met with in the Prairie Provinces. However, considering the scarcity of records, the species must be of accidental or very rare occurrence in Saskatchewan.

CHARLES D. BIRD

Department of Botany and Plant Pathology
Oklahoma Agricultural and Mechanical College
Stillwater, Oklahoma

[Ed Note: The author was formerly Seasonal Technical Officer, Canadian Wildlife Service.]

FINANCIAL STATEMENT OF THE OTTAWA FIELD-NATURALISTS' CLUB, NOVEMBER 29, 1956

CURRENT ACCOUNT

Assets

Balance in Bank, Nov. 29/56	$3,043.87
Bills receivable	200.50
Lodge, estimated value	160.00
	$3,404.37

Liabilities

Audubon Screen Tours, guarantee	$ 750.00
Bills outstanding	10.00
Balance	2,644.37
	$3,404.37

Receipts

Balance in Bank, Dec. 1/55		2,837.30
Fees:		
Current	$896.41	
Advance and arrears	425.93	
Assoc.	36.00	1,358.34
Separates		649.70
Single and Back Numbers		371,10
Sale Macoun Biography		27.40
Donations		39.00
Miscellaneous		57.72
Audubon Screen Tours (net)		76.02
		5,416.58

Expenditures

Can. Field Nat. (3 numbers)	1,465.20
Illustrations	123.67
Separates	353.35
Business Manager's Honorarium	15.00
Excursions & Lectures Committee	100.00
Newsletter (2 numbers)	80.41
Postage and Stationery	174.19
Bank Exchange	9.55
Foreign Exchange	6.23
Miscellaneous	45.11
Bank Balance, Nov. 29/56	3,043.87
	5,416.58

RESERVE FUND

Assets

$3000 Ontario Hydro 3% Bonds, Market Value	$2,580.00
11 shares Bell Telephone Stock, Market Value	495.00
Balance in Bank, Nov. 29/56	134.75
	$3,209.75

Liabilities

NIL

Receipts

Balance in Bank, Dec. 1/55	570.51
Bank interest	3.98
Bond interest	90.00
Dividends, Bell Telephone	15.50
Sale 2 rights, Bell Telephone	1.96
	$ 681.95

Expenditures

Rent Safety Deposit Box	5.00
Bank Charges	.20
Purchase 11 shares Bell Telephone	542.00
Balance in Bank, Nov. 29/56	134.75
	$ 681.95

PUBLICATIONS FUND

Assets

$1500 Ontario Hydro 3% Bonds, Market Value	1,290.00
Balance in Bank, Nov. 29/56	398.75
	$1,688.75

Liabilities

NIL

Receipts

Balance in Bank, Dec. 1/55	346.46
Bank interest	7.29
Bond interest	45.00
	$ 398.75

Expenditures

Balance in Bank, Nov. 29/56	$ 398.75
	$ 398.75

Audited and found correct.

(Signed) I.L. CONNERS
C. FRANKTON
Auditors

November 29, 1956.

R. J. MOORE
Treasurer

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Webster's New International Dictionary is the authority for spelling.

References are made by the author-date system. They should be listed alphabetically and typed at the end of the main body of text. For titles in reference matter abbreviations follow the rules in the *International Code for the Abbreviation of Titles of Periodicals* and the *World List of Scientific Periodicals.*

Other abbreviations should be used sparingly. The better-known terms of measurement follow CSA Specification Z85-1943 *Abbreviations for Scientific and Engineering Terms* or the equivalent of the American Standards Association (Z10.1-1941).

Tables should be titled and numbered consecutively in arabic numerals. Tables and legends for the figures should be placed after the list of references. Each table and all the legends should be on separate pages.

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A GUIDE

to the

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of the

OTTAWA DISTRICT

by

ALICE E. WILSON

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OTTAWA ONTARIO

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PLANTS OF WATERTON LAKES NATIONAL PARK, ALBERTA

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INTRODUCTION

Waterton Lakes National Park is situated in southwestern Alberta on the east side of the Continental Divide. It embraces an area of 204 square miles, consisting mostly of imposing masses of high mountains that rise almost abruptly above the adjacent plains of Alberta. The outstanding floristic feature of the area is the coniferous evergreen forest which covers at least two thirds of the mountain slopes. Grassland occupies much of the bordering foothills and the mountain summits support alpine vegetation. The wide variety of climate, topography and exposure is reflected by a flora rich in number of species and luxuriantly developed.

During July and August, 1953, the author made a botanical survey of Waterton Lakes National Park, securing over 2000 collection numbers. One to several duplicates of each were secured, totaling approximately 7000 herbarium sheets. An effort was made to collect one or more specimens of each species in the area. A set of specimens has been deposited in each of the following institutions: Chicago Natural History Museum, Chicago, Illinois; New York Botanical Garden, New York, New York; University of Alberta, Edmonton, Alberta; Southern Methodist University, Dallas, Texas, and University of California, Berkeley, California.

GEOLOGY AND PHYSIOGRAPHY

The mountains within the park are carved out of Precambrian rocks that are among the oldest sediments exposed on the earth's crust. They vary in color from purple to green with red predominating.

This ancient plateau has been deeply dissected by erosion and plowed by former glaciers into sharp summits, precipitous sides and numerous valleys in which streams now flow eastward into Hudson Bay, by way of the Saskatchewan-Nelson river system.

Waterton Lakes Park is unique with respect to its superb glacial sculpturing, where the work of former glaciers may be observed in the many cirques, rock basin lakes, hanging valleys and waterfalls. Large and small lakes lie in valleys or are cradled in the glacial basins on the mountain sides situated at various elevations and in general, they decrease in size with altitude. Occasionally, miniature alpine lakes are cradled high up near the summits. Sometimes two or three of these emerald or turquoise lakes are found at the head of a hanging valley, terraced in altitudinal succession with water cascading over rocky precipices from the upper lake to the next one below and so on down.

A conspicuous feature of the park area is the chain of lakes from which the park derives its name. The largest is Upper Waterton Lake, eight miles in length, one half mile wide and in places over 400 feet deep. This lake occupies a northerly trending fault that has been considerably deepened and widened by a valley glacier.

Valley glaciers once pushed up against the north and northeast sides of the mountain cores leaving numerous deeply gouged cirques, many of which contain beautiful lakes. The lakes are fed directly from the surrounding snow banks resting on huge talus slopes which lean against the almost perpendicular back and side walls of the cirques that tower up to 2500 feet above the basin floor. The water is icy cold, consequently the aquatic vegetation is very limited. Ice still remained over a portion of Crypt Lake on August 1.

Nivation is active on most of the higher mountains. In the cirques, large masses of snow accumulate. The snow remains until late in July and consists largely of avalanche snow mixed with small and large rock

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brought down from the upper rims. Because of the prevailing southwest winds, winter snow has a tendency to drift to the leeward sides of high mountain ridges where huge snow cornices remain until late in summer. In cirques, which evidently contained small alpine glaciers not so very long ago, snow fields may remain for two or three successive summers without melting completely. Persistence of snow fields is dependent upon the amount of winter snowfall and summer temperature which vary from year to year. Only those plants that are adapted to prolonged periods of dormancy can survive.

At high elevations rapid weathering is noticed in talus slopes and rock slides that cover the base of all steep mountains. Huge rock screes, fresh and without moss or lichen growth, cover the base of all cirque rims. Shale slides are most extensive on the south-facing slopes.

Avalanche paths or snow-slide channels are common on all the higher mountains, particularly on the southern slopes. It is presumed that they are caused by the early loosening of snow during thaws at or above timberline. Insolation would, no doubt, be more rapid here than under forest cover at lower levels. Every winter or spring these huge masses of snow sweep down the mountain sides and cut deep swaths into the forest which in summer appears as stripes of lighter green vegetation seen for miles away. Any trees in the path of an avalanche are broken off or uprooted and only willow (*Salix* sp.) and alder (*Alnus* sp.) shrubs that bend readily can survive this scouring effect. These shrubs are pressed flat against the mountain sides with the tips downward which curve up again during the summer when they form impenetrable thickets.

CLIMATE

The climate of the region is rigorous owing to great extremes of temperature between summer and winter seasons, influenced by annual and seasonal variations in precipitation and strong, drying westerly winds. There are frequent and wide variations in temperature between day and night and from day to day at all seasons and at different elevations. The climate is characterized by short, warm summers with cool nights and long, cold winters, modified periodically by the warm westerly chinook winds. During the winter, low temperatures prevail. Most of the winter precipitation comes in the form of snow and the ground remains frozen from about the middle of October until April. The average annual precipitation at Waterton is 30.06 inches of which 8.45 inches (or 30 percent) falls during the active growing months of May, June and July when it is most effective.

Owing to a topographic relief of approximately 5400 feet in the area, both climate and vegetation show a close relationship to altitude. However, almost endless varieties of local climates exist within these mountains. Atmospheric conditions vary greatly with altitude and exposure. Valleys are very different climatically from exposed peaks; windward slopes contrast strongly with those having leeward positions and flanks exposed to the southward are drier and hotter than those exposed to the opposite direction and these in turn differ with elevation.

With increased elevation, there is a decrease in temperature that affects the growing season, causing it to become progressively shorter up the mountain sides. Precipitation increases and evaporation decreases with elevation. Evidence indicates that forest fires are less frequent in the moist, subalpine zone than at lower elevations where the summers are warmer and drier.

VEGETATION

The vegetation of Waterton Park is composed of grassland, forest and tundra, distributed in successive altitudinal zones along the mountain slopes. There is a close correlation between vegetation and climate, particularly temperature and precipitation as influenced by its geographic and topographic relations. The zonal distribution of plants is the result of varying conditions of temperature and moisture as influenced by exposure and elevation. Moisture and especially temperature vary greatly at different elevations and each plant species reaches its best development at the elevation where conditions are most congenial to its growth.

Where these associations merge into each other, their boundaries are not always sharply marked and frequently irregular because of local conditions, available moisture, prevailing exposure and topography.

Plants of high altitudes are often found at comparatively low elevations on the northward slopes where there is less evaporation and consequently more moisture and the temperature is somewhat lower than on the southward slopes where conditions vary in the opposite direction and plants of low altitudes are found at high elevations on sunny slopes.

In Waterton Park, snow banks remain on northward slopes nearly all summer at comparatively low elevations. Around these snow fields, plants characteristic of alpine meadows are found.

Timberline is at approximately 7000 feet in this area, although it may vary as much as 500 feet up or down depending on local conditions which are not uniform at a given altitude. Grassland extends to higher elevations on the sunny slopes where the prevailing dry southwest winds have a pronounced effect and, by increased evaporation, add to the xeric conditions.

On exposed southward slopes above timberline, plants occasionally occur which are representative of the grassland or foothills far below on the plains. Only a small number of alpine species are found at low altitudes on river bars carried down from higher elevations by the spring floods.

Each plant species has a maximum as well as a minimum temperature tolerance which controls its distribution and relative abundance. Some plants have a much wider range whereas others are confined strictly to one zone. The latter plants are zone indicators whereby elevation can be determined within a few hundred feet.

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ANNOTATED CATALOGUE OF THE VASCULAR PLANTS

The appended annotated catalogue of the vascular plants, totaling 862 entities, is based mainly on the collections made by the author. A small number of species collected by others, but not found by the author are included to make the list as complete as possible. The following symbols indicate the herbaria from which specimens are cited:

CAN — National Herbarium of Canada, Ottawa, Ontario.
DAL — Department of Agriculture, Lethbridge, Alberta.
UNA — University of Alberta, Edmonton, Alberta.
US — United States National Herbarium, Washington, D.C.
WCM — Herbarium of W. C. McCalla, Calgary, Alberta.

Botanists who made collections in this area include: John Macoun, Dr. A. E. Porsild, Dr. M. O. Malte, Dr. E. H. Moss, W. C. McCalla, J. J. Sexsmith, and Dr. F. J. Hermann. However, no paper has previously been published on the plants of Waterton Lakes National Park. With further exploration in the region, additional species undoubtedly will be discovered.

OPHIOGLOSSACEAE

Botrychium lunaria L. Grassland at edge of woods, Waterton townsite. Only one individual plant found.

B. virginianum (L.) Sw. In rich woods along highway near international boundary; uncommon.

POLYPODIACEAE

Adiantum pedatum L. Damp woods and open boulder-strewn slopes near timberline; uncommon.

Asplenium viride Huds. A few plants found in rock crevice near summit of Sofa Mountain. Crevices along trail to Bertha Lake, *F. J. Hermann, 13077* (US).

Athyrium alpestre (Hoppe) Rylands var. **americanum** Butters (*A. americanum* (Butters) Maxon) Occasional on open boulder slope above Crypt Lake and along brook near Goat Lake at timberline.

A. felix-femina (L.) Roth var. **cyclosorum** (Ledeb.) Moore (*A. cyclosorum* Ledeb; *A. felix-femina* subsp. *cyclosorum* (Ledeb.) C. Chr.) Common in damp coniferous forest at middle altitudes, especially abundant around Cameron Lake where numerous springs trickle down the mountain slopes.

Cryptogramma crispa (L.) R. Br. var. **acrostichoides** (R. Br.) Clarke (*C. acrostichoides* R. Br.; *C. crispa* subsp. *acrostichoides* (R. Br.) Hultén) Frequent on exposed slopes at upper elevations.

C. stelleri (S. G. Gmel.) Prantl. Found on damp overhanging cliffs; west shore of Waterton Lake and Red Rock Canyon.

Cystopteris fragilis (L.) Bernh. (*Filix fragilis* (L.) Gilib.) Occasional on moist shaded stream banks and ledges at all elevations.

Dryopteris austriaca (Jacq.) Woynar (*D. dilatata* (Hoffm.) A. Gray; *D. spinulosa* (O. F. Mueller) Kuntze var. *dilatata* (Hoffm.) Underw.) Moist coniferous woods near Bertha Lake; scarce.

Gymnocarpium dryopteris (L.) Newman (*Dryopteris linnaeana* C. Chr.; *D. disjuncta* (Ledeb.) Morton) Common in damp coniferous woods at middle elevations.

Polypodium vulgare L. var. **columbianum** Gilbert (*P. hesperium* Maxon) Crevices on moist overhanging cliff, west shore of Waterton Lake and on east slope of Mt. Crandell.

Polystichium lonchitis (L.) Roth Occasional on open slopes at upper elevations near timberline.

Pteridium aquilinum (L.) Kuhn var. **pubescens** Underw. (*Pteritis aquilina* L. var. *pubescens* (Underw.) Kuntze) In dry lodgepole pine woods, west side of Waterton Lake.

Woodsia scopulina D. C. Eaton Frequent on exposed slopes at middle and upper elevations.

EQUISETACEAE

Equisetum arvense L. Common in moist woods at low and middle elevations.

E. fluviatile L. (*E. limosum* L.) Occasional in quiet ponds and slow-moving streams at low elevations.

E. hyemale L. var. **pseudohyemale** (Farw.) Morton (*E. affine* Engelm.) Occasional on gravel bars of the Belly River.

E. laevigatum A. Br. (*E. kansanum* Schaffn.) Occasional in dry meadows and on grassy hillsides at low elevations.

E. palustre L. Marshy place along the Belly River; not observed elsewhere in the park.

E. pratense L. Occasional in moist woods at middle elevations, associated with *E. arvense*.

E. scirpoides Michx. In spruce woods along brook, vicinity of Sofa Mountain.

E. variegatum Schl. Frequent on gravel bars along the Belly River.

LYCOPODIACEAE

Lycopodium annotinum L. Occasional in coniferous woods at middle elevations.

SELAGINELLACEAE

Selaginella densa Rydb. Common on prairie along the eastern border of the park at lower elevations.

S. densa var. **scopulorum** (Maxon) Tryon Common on talus slopes, dry ledges, cliffs and alpine summits.

S. wallacei Hieron (*S. montanensis* Hieron) Found once on east slope of Mt. Crandell at middle elevation.

ISOETACEAE

Isoetes bolanderi Engelm. Quiet pool along west end of Summit Lake near timberline.

PINACEAE

Abies lasiocarpa (Hook.) Nutt. Common forest tree at middle and upper elevations. Becoming dwarf, stunted and often prostrate on exposed slopes at timberline.

Juniperus communis L. var. **saxatilis** Pallas (*J. communis* var. *montana* Ait.; *J. sibirica* Burgsd; *J. nana* Willd.) Occasional on open slopes at middle and upper elevations.

J. horizontalis Moench (*Sabina horizontalis* (Moench) Rydb.) Occasional on dry exposed prairie hillsides near east park boundary at lower elevations.

Larix lyallii Parl. Common at timberline where it forms a narrow belt of trees. Conspicuous in autumn when the needles turn golden yellow before falling off. Also noted on mountains across the international boundary in adjacent Glacier National Park.

Picea engelmanni Parry A common forest tree on moist slopes at middle and upper elevations.

P. glauca (Moench) Voss var. **albertiana** (S. Brown) Sarg. (*P. albertiana* S. Brown) Common in the Belly River valley.

Pinus albicaulis Engelm. (*P. flexilis* var. *albicaulis* (Engelm.) Engelm.; *Apinus albicaulis* (Engelm.) Rydb.) Frequent at timberline. A fine stand of this tree was observed near Crypt Lake.

P. contorta Doug. var. **latifolia** Engelm. (*P. contorta* var. *murrayana* (Grev. & Balf.) Engelm.; *P. murrayana* Grev. & Balf.) Abundant at lower and middle elevations, constituting the dominant forest cover in the park area; regenerating rapidly following fire. *Arceuthobium americanum*, parasitic on this tree, was not located in the park area but possibly does occur. It is reported from Glacier National Park to the south and from Banff Park to the north.

P. flexilis James (*Apinus flexilis* (James) Rydb.) Frequent on dry hills and exposed slopes from lower elevations to timberline.

P. monticola Dougl. (*P. strobus* L. var. *monticola* (Dougl.) Nutt.; *Strobus monticola* (Dougl.) Rydb.) Authentic specimens of this species with cones were collected on rocky southeast slope near base of Mt. Crandell by *W. C. McCalla, 6750* (UNA, WCM). Mr. McCalla (personal correspondence) states that he observed several trees in that locality.

Pseudotsuga menziesii (Mirb.) Franco var. **glauca** (Beissn.) Franco (*P. taxifolia* (Lamb.) Britton var. *glauca* (Beissn.) Sudw.) Common tree on dry slopes at low and middle elevations, forming pure stands or associated with other coniferous tree species.

TYPHACEAE

Typha latifolia L. Found only in one pond near Waterton River crossing.

SPARGANTACEAE

Sparganium angustifolium Michx. In shallow water at Maskinonge Lake.

S. multipedunculatum (Morong) Rydb. Margin of beaver pond in vicinity of Sofa Mountain.

POTAMOGETONACEAE

Potamogeton filiformis Pers. (*P. interior* Rydb.) Frequent in quiet ponds and sluggish streams.

P. gramineus L. (*P. heterophyllus* Schreb.) In beaver ponds, vicinity of Sofa Mountain.

P. perfoliatus L. var. **richardsonii** Benn. (*P. richardsonii* (Benn.) Rydb.; *P. perfoliatus* subsp. *richardsonii* (Benn.) Hultén). Common in Maskinonge Lake.

P. pusillus L. In quiet pond near Waterton River crossing.

SCHEUCHZERIACEAE

Triglochin maritima L. Marshy shores of ponds and lakes at low and middle elevations; occasional.

ALISMACEAE

Alisma gramineum K. C. Gmel. (*A. geyeri* Torr.) In shallow water along edge of pond near east park boundary.

A. plantago-aquatica L. var. **brevipes** (Greene) Farwell (*A. triviale* Pursh) Marshy north shore of Maskinonge Lake.

Sagittaria cuneata Sheldon Occasional in shallow water of quiet lakes and sluggish streams.

GRAMINEAE

Agropyron albicans Scribn. & Smith var. **griffithsii** (Scribn. & Smith) Beetle (*A. griffithsii* Scribn. & Smith) One plant found on prairie between Waterton River crossing and east park entrance; apparently scarce.

A. dasystachyum (Hook.) Scribn. Frequent on prairie near east park boundary.

A. inerme (Scribn. & Smith) Rydb. (*A. spicatum* var. *inerme* (Scribn. & Smith) Heller) Frequent on prairie near east park boundary.

A. latiglume (Scribn. & Smith) Rydb. Common on open mountain slopes above timberline and extending sporadically into *Larix* and *Abies* woods.

A. scribneri Vasey Occasional on windswept alpine mountain peaks; Mt. Carthew, Mt. Richards and Sofa Mtn. A unique feature of this plant is the prostrate culms.

A. smithii Rydb. Plants forming a bluish-green zone on dry bank of pond near east park entrance. Not observed elsewhere in the park area.

A. spicatum (Pursh) Scribn. & Smith Common on open slopes at low and middle elevations.

A. trachycaulum (Link) Malte (*A. pauciflorum* (Schw.) Hitchc., not Schur; *A. tenerum* Vasey; *A. trachycaulum* var. *majus* (Vasey) Fern.; var. *novae-angliae* (Scribn.) Fern.) Frequent on prairie and open mountain slopes.

A. trachycaulum var. **unilaterale** (Cassidy) Malte (*A. subsecundum* (Link) Hitchc.) Common on prairie and in open woods at low and middle elevations.

Agrostis alba L. Occasional along roadsides at low elevations.

A. exarata Trin. Frequent in damp meadows at low and middle elevations.

A. palustris Huds. Occasional along brooks and wet shores at low elevations.

A. scabra Willd. Frequent in meadows at low and middle elevations.

A. scabra var. **geminata** (Trin.) Swallen Alpine slope of Mt. Crandell.

A. thurberiana Hitchc. Common in subalpine meadows.

Alopecurus aequalis Sobol Occasional in boggy meadows and stream margins at low elevations.

A. glaucus Less. (*A. occidentalis* Scribn. & Tweedy) Frequent in aspen woods at low elevations. Culms 3 to 4 feet high.

Beckmannia syzigachne (Steud.) Fern. Marshy north shore of Maskinonge Lake; scarce.

Bromus anomalus Rupr. (*B. porteri* Nash) On low prairie between Waterton River crossing and east park boundary. Not observed elsewhere in the park area.

B. ciliatus L. (*B. richardsonii* Link) Common in thickets along streams and on wooded hillsides at low elevations.

B. commutatus Schrad. Introduced annual roadside weed at low elevations.

B. inermis Leyss. Occasional along roadsides and trails. Probably introduced with hay used to feed horses on pack trails.

B. marginatus Nees (*B. breviaristatus* Buckl.) Common in thin woods and open slopes, extending from lower elevations almost to timberline. Variable in degree of pubescens on sheaths and blades.

B. pumpellianus Scribn. Frequent on prairie and open slopes at low and middle elevations.

B. pumpellianus var. **tweedyi** Scribn. On north-facing bank of Waterton River and above timberline on Mt. Crandell where it was dwarfed; having culms 3 to 4 dm. high.

B. tectorum L. Introduced annual weed along roadsides at low elevations.

B. vulgaris (Hook.) Shear Frequent in coniferous woods at lower and middle elevations. Specimens distributed as *Melica smithii* belong here.

Calamagrostis canadensis (Michx.) Beauv. Frequent in meadows and open woods at lower elevations.

C. inexpansa A. Gray Occasional in boggy meadows and river banks at low elevations.

C. montanensis Scribn. Occasional on dry prairie and exposed hillsides at low elevations near east park boundary.

C. neglecta (Ehrh.) Gaertn., Mey. & Schreb. Frequent in boggy meadows near beaver pond, vicinity of Sofa Mountain.

C. purpurascens R. Br. (*C. vaseyi* Beal) Frequent on open slopes of the coniferous forest belt at low and middle elevations.

C. rubescens Buckl. Occasional in pine and aspen woods at low and middle elevations.

Calamovilfa longifolia (Hook.) Scribn. Occasional on dry exposed hillsides in prairie near east park entrance at low elevation.

Catabrosa aquatica (L.) Beauv. Along spring in rich poplar woods near Waterton River bridge. Not observed elsewhere.

Cinna latifolia (Trev.) Griseb. Frequent along springs in forest at low and middle elevations.

Danthonia californica Boland. var. **americana** (Scribn.) Hitchc. (*D. americana* Scribn.) Found in three localities on moist prairie along Chief Mountain International Highway. Apparently infrequent.

D. intermedia Vasey Frequent on prairie at lower elevations.

D. parryi Scribn. Common component of the grassland in the foothills along the east park boundary.

D. unispicata (Thurb.) Munro Open, dry, south-facing slope of Mt. Glendowan at an elevation of 5,000 feet. Apparently scarce.

Deschampsia atropurpurea (Wahl.) Scheele Frequent along springs in coniferous woods and subalpine meadows at middle and upper elevations.

D. caespitosa (L.) Beauv. Occasional in bogs and wet meadows at lower elevations.

D. elongata (Hook.) Munro Opening in dry, lodgepole pine woods, vicinity of Cameron Lake.

Elymus canadensis L. Bank of Crooked Creek near east park entrance at low elevation.

E. cinereus Scribn. & Merr. (*E. condensatus* Presl. var. *pubens* Piper) On south-facing slope of prairie between Waterton River crossing and east park entrance. Culms 6 feet high.

E. glaucus Buckl. Common in moist openings in pine and aspen woods at low and middle elevations.

E. innovatus Beal Found in mixed woods of Belly River valley and grassy east slope of Sofa Mountain at low and middle elevations.

E. macounii Vasey Occasional on prairie and along roadsides at low elevation.

Festuca altaica Trin. var. **major** (Vasey) Gleason (*F. scabrella* var. *major* Vasey; *F. campestris* Rydb.) Occasional on open slopes from middle elevation to timberline.

F. altaica var **scabrella** (Torr.) Breitung[1] (*F. scabrella* Torr.; *F. hallii* (Vasey) Piper) Common on prairie in the foothills and along the east park boundary at low elevation.

F. elatior Trin. Roadside through prairie at Waterton River crossing and vicinity of Sofa Mountain at lower elevation.

F. idahoensis Elmer Common on dry hills and prairie at lower elevation, extending less commonly almost to timberline.

F. occidentalis Hook. Occasional in dry coniferous woods and rocky shores from lower elevation to timberline.

F. ovina L. var. **brachyphylla** (Schult.) Piper (*F. brachyphylla* Schult.) Common on exposed, windswept mountain tops above timberline.

F. ovina var. **saximontana** (Rydb.) Gleason (*F. saximontana* Rydb.) On open morainic ridge, east slope of Sofa Mountain at middle elevation.

F. rubra L. (*F. vallicola* Rydb.) Found in beaver meadow and in grassland along Chief Mountain International Highway in vicinity of Sofa Mountain.

F. subulata Trin. In mixed pine and aspen woods, west shore of Waterton Lake. Not observed elsewhere in the park area.

Glyceria borealis (Nash) Batchelder (*Panicularia borealis* Nash) Occasional in shallow water and shores of lakes and streams at lower elevation.

G. elata (Nash) Hitchc. (*P. elata* Nash; *P. nervata* (Willd.) Kuntze var. *elata* (Nash) Piper) Moist shaded banks of Waterton and Belly Rivers at low elevation.

G. maxima Hartm. & Holmb. var. GRANDIS (S. Wats.) Breitung, comb. nov. (*G. grandis* S. Wats. ex A. Gray, Man. ed. 6. 667. 1890; *G. maxima* subsp. *grandis* (S. Wats.) Hultén) Occasional along marshy shores of lakes and streams at low elevation. Specimens distributed as *G. pauciflora* belong here.

G. striata (Lam.) Hitchc. (*G. nervata* Willd.; *P. nervata* (Willd.) Kuntze) Frequent in damp woods and shaded stream banks at low elevation.

Helictotrichon hookeri (Scribn.) Henr. (*Avena hookeri* Scribn.) Common on prairie along east park boundary at lower elevation.

Hierochloe odorata (L.) Beauv. (*Torresia odorata* (L.) Hitchc.) Wet beaver meadow in vicinity of Sofa Mountain at lower elevation.

Hordeum jubatum L. Occasional along roadsides. It appeared to be introduced into the park area.

H. jubatum var. **caespitosum** (Scribn.) Hitchc. (*H. caespitosum* Scribn.) Frequent in damp sedge meadows near the east park boundary at low elevation.

Koeleria cristata (L.) Pers. Common on dry prairie at lower elevation and on summit of Mt. Crandell.

Melica bulbosa Geyer (*M. bella* Piper) Occasional on open slopes at middle and upper elevations; Mt. Glendowan.

M. smithii (Porter) Vasey In coniferous woods along trail to Bertha Lake, alt. ca. 4400 feet, *F. J. Hermann, 13065* (US).

M. subulata (Griseb.) Scribn. In moist conferous woods around Cameron Lake at middle elevation.

Muhlenbergia richardsonis (Trin.) Rydb. (*M. squarrosa* (Trin.) Rydb.) Occasional in moist meadows, lower elevations.

Oryzopsis asperifolia Michx. In pine woods; Belly River valley at lower elevations.

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[1] In this paper, botanical names followed by the present author's name without basonyms will appear with basonyms in the Amer. Midl. Nat. Vol. 56, No. 4, 1957, in which journal they were accepted for publication in 1953.

O. exigua Thurb. Exposed mountain slopes at middle elevation on Mt. Glendowan and at timberline on Mt. Crandell.

Phalaris arundinacea L. Wet meadow along Waterton River near crossing; scarce.

Phleum alpinum L. Common in damp meadows at middle and upper elevations.

P. pratense L. Common along roadsides and established in moist meadows.

Poa alpina L. Common on alpine slopes of high mountains.

P. ampla Merr. Occasional in grassland of the foothills near east park boundary.

P. annua L. Introduced weed in disturbed ground at Waterton village.

P. canbyi Nash Occasional on grassy slopes at middle and upper elevations.

P. compressa L. Introduced weed along roadside in Waterton River valley.

P. epilis Scribn. (Det. D. D. Keck as *P. incurva* Scribn. & Will.) Common in alpine and subalpine meadows.

P. glauca Vahl Open rocky slope near Cameron Lake; middle elevation.

P. glaucifolia Scribn. & Will. Frequent in aspen and pine woods at low and middle elevations.

P. gracillima Vasey Common on open slopes in alpine and subalpine zones.

P. interior Rydb. Frequent in thickets and grassy slopes at low and middle elevations.

P. longipila Nash At timberline near Carthew Lakes.

P. palustris L. Common in wet woods and shores at lower elevations.

P. pattersoni Vasey Alpine summit of Avion Ridge; scarce.

P. pratensis L. Occasional on prairie near east park boundary.

P. rupicola Nash Common above timberline on high mountains.

Schizachne purpurascens (Torr.) Swallen (*Avena striata* Michx.) Dry pine woods in Belly River valley; not observed elsewhere in the park area.

Sitanion hystrix (Nutt.) J. C. Smith (*S. montanum* J. G. Smith) Near timberline on grassy ledge above Crypt Lake and on east slope of Sofa Mountain near fire lookout tower.

Stipa columbiana Macoun Frequent on prairie and open hillsides at lower elevations.

S. columbiana var. **nelsonii** (Scribn.) Hitchc. (*S. nelsonii* Scribn.) Taller and coarser than the typical species with which it is associated, but less frequent.

S. comata Trin. & Rupr. Dry eroded prairie hillside between Waterton River bridge and east park entrance.

S. richardsonii Link Occasional on low prairie and border of woods at lower elevations.

S. spartea Trin. var. **curtiseta** Hitchc. (*S. tweedyi* Scribn.) Frequent on prairie toward east park boundary at lower elevations.

S. viridula Trin. Frequent on exposed stream banks and prairie at low elevations.

Trisetum canescens Buckl. In dry coniferous woods, east slope of Mt. Crandell at middle elevation.

T. cernuum Trin. In moist coniferous woods above Cameron Lake along trail to Summit Lake.

T. montanum Vasey Crevices in argellite bluff on trail to Bertha Lake, alt. 5600 feet, *F. J. Hermann, 13080* (UNA, US). New to Canada. Det. J. R. Swallen.

T. spicatum (L.) Richt. Frequent in dry pine woods at all elevations, extending above timberline.

T. wolfii Vasey (*Graphiphorum wolfii* Vasey; *G. muticum* (Bolander) Greene) Occasional in dry pine woods at middle elevations.

Triticum aestivum L. Introduced annual along roadsides near Waterton River; probably not persistent.

CYPERACEAE

Carex albo-nigra Mack. Carthew Pass above timberline; probably not rare.

C. aperta Boott Edge of aspen grove on north shore of Lonesome Lake at low elevation.

C. aquatilis Wahl. Frequent in marshes at lower elevations.

C. atherodes Spreng. Occasional in wet meadows and springy places in poplar woods at lower elevations.

C. athrostachya Olney Occasional along marshy shores at lower elevations.

C. atrosquama Mack. (*C. atrata* L. subsp. *atrosquama* (Mack.) Hultén) Moist meadow in forest opening on east slope of Sofa Mountain at middle elevation.

C. **bebbii** Olney Frequent in wet meadows at lower elevations.

C. **brevior** (Dewey) Mack. Marshy north shore of Maskinonge Lake at low elevation.

C. **buxbaumii** Wahl. Frequent in boggy meadows around beaver ponds, vicinity of Sofa Mountain.

C. **canescens** L. Boggy openings in coniferous woods at north end of Cameron Lake.

C. **capillaris** L. var. **elongata** Olney Frequent in boggy meadows around beaver ponds, vicinity of Sofa Mountain at middle elevation.

C. **concinna** R. Br. In moist spruce woods near brook, vicinity of Sofa Mountain at middle elevation.

C. **concinnoides** Mack. Dry pine woods at Red Rock Canyon; middle elevation.

C. **crawfordii** Fern. Occasional in moist meadows and wet shores at lower and middle elevations.

C. **deweyana** Schw. Occasional in woods and open slopes at lower and middle elevations.

C. **diandra** Schrank Boggy edge of beaver pond, vicinity of Sofa Mountain at low elevation.

C. **disperma** Dewey Moist spruce woods along brook, vicinity of Sofa Mountain at middle elevation.

C. **festivella** Mack. Common in damp meadows at lower elevations and sparingly on grassy slopes at middle elevations.

C. **filifolia** Nutt. On exposed, dry, south-facing slopes in grassland north of Waterton River.

C. **flava** L. Occasional in bogs at middle elevations; Cameron Lake and beaver meadows, vicinity of Sofa Mountain.

C. **foenea** Willd. (*C. siccata* Dewey) Gravel bar in Belly River valley at low elevation.

C. **geyeri** Boott Occasional in coniferous woods at low and middle elevations.

C. **gynocrates** Wormskj. In bogs and wet spruce woods in vicinity of Sofa Mountain.

C. **hassei** Bailey (*C. garberi* Fern. var. *bifaria* Fern.) Occasional in bogs vicinity of Sofa Mountain.

C. **haydeniana** Olney (*C. nubicola* Mack.) Occasional in alpine and subalpine meadows; Goat Lake.

C. **heliophila** Mack. (*C. pensylvanica* Lam. var. *digyna* Böck.) On dry, open, south-facing slope of Mt. Glendowan at middle elevation.

C. **hoodii** Boott Frequent on grassy slopes extending from lower to upper elevations.

C. **interior** Bailey Occasional in bogs of the beaver pond area, vicinity of Sofa Mountain.

C. **kelloggii** Boott Frequent in bogs and shores at middle and upper elevations; Cameron Lake, Summit Lake.

C. **lanuginosa** Michx. (*C. lasiocarpa* Ehrh. var. *latifolia* (Böck.) Gilly) Occasional in damp meadows and marshes at lower elevations.

C. **leptalea** Wahl. Moist spruce woods near brook, vicinity of Sofa Mountain.

C. **limosa** L. Bogs in beaver pond area, vicinity of Sofa Mountain.

C. **livida** (Wahl.) Willd. Occasional in bogs of beaver pond area, vicinity of Sofa Mountain.

C. **media** R. Br. (*C. vahlii* Schk. var. *inter-alpina* (Wahl.) Fern.; *C. angarae* Steud.) Along brook in coniferous woods near Cameron Lake at middle elevation.

C. **microptera** Mack. Spruce trail to Carthew Pass, east shore of Cameron Lake, alt. 5800 feet, *F. J. Hermann*, 13053 (UNA).

C. **nardina** Fries var. **hepburnii** (Boott) Kükenth. Frequent on exposed alpine slopes.

C. **nigricans** C. A. Meyer Boggy shores of subalpine lakes; Summit Lake.

C. **obtusa** Lilj. Frequent on dry ridges in prairie.

C. **pachystachya** Cham. Occasional in moist meadows and along springs at low and middle elevations.

C. **petasata** Dewey Gravelly clearing about 3 miles north of Waterton Park townsite on Red Rock Canyon road, *F. J. Hermann*, 12639 (UNA).

C. **phaeocephala** Piper Occasional on grassy slopes extending from middle elevation to timberline.

C. **physocarpa** Presl (*C. saxatilis* L. var. *major* Olney) In boggy meadow, beaver pond area, vicinity of Sofa Mountain and in marsh at north end of Maskinonge Lake.

C. **platylepis** Mack. Moist roadside ditch at edge of woods, north shore of Cameron Lake, alt. 5400 feet, *F. J. Hermann*, 13041 (UNA, CAN).

C. **podocarpa** R. Br. Frequent in wet subalpine meadows; Cameron Lake, Crypt Lake, Bertha Lake.

C. **praticola** Rydb. Occasional in moist grassland at Lonesome Lake and near east park entrance at low elevation.

C. **preslii** Steud. Frequent in coniferous woods at middle and upper elevations.

C. **raynoldsii** Dewey Common in subalpine meadows; Bertha Lake, Goat Lake, Rowe Lake.

C. **rossii** Boott Occasional in open coniferous woods, extending from lower elevations to timberline.

C. **rupestris** All. var. **drummondiana** (Dewey) Bailey (*C. drummondiana* Dewey) Occasional on windswept mountain summits and dry prairie hilltop near north park entrance.

C. **sartwellii** Dewey In boggy meadow of beaver pond area, vicinity of Sofa Mountain.

C. **scirpoidea** Michx. Boggy edge of beaver pond in vicinity of Sofa Mountain and on ledge above Crypt Lake; middle and upper elevations.

C. **simulata** Mack. Boggy edge of beaver pond in vicinity of Sofa Mountain.

C. **sprengelii** Dewey Damp meadow along north shore of Waterton Lake.

C. **stenophylla** Wahl. var. ELEOCHARIS (Bailey) Breitung, comb. nov. (*C. eleocharis* Bailey, Mem. Torr. Club 1: 6, 1889; *C. stenophylla* subsp. *eleocharis* (Bailey) Hultén) Dry windswept hilltop near north park entrance; probably not rare.

C. **tenera** Dewey Occasional in damp meadows and along shores at lower elevations.

C. **tolmiei** Boott Frequent in alpine and subalpine meadows.

C. **vesicaria** L. In dried-up pond at north end of Waterton Lake.

C. **viridula** Michx. (*C. oederi* Retz. var. *viridula* (Michx.) Kükenth.) Occasional in bogs at beaver pond area in vicinity of Sofa Mountain.

C. **xerantica** Bailey Dry prairie near north park entrance.

Eleocharis acicularis (L.) Roem. & Schult. Frequent in shallow water and on mud at lower elevations.

E. **macrostachya** Britt. Common in marshes and boggy meadows at lower elevations. Probably not distinct from *E. palustris* (L.) Roem. & Schult.

E. **pauciflora** (Lightf.) Link (*Scirpus pauciflorus* Lightf.). In bog at north end of Cameron Lake and vicinity of Sofa Mountain.

Eriophorum angustifolium Honckeny Bogs around beaver pond area in vicinity of Sofa Mountain.

E. **chamissonis** C. A. Meyer In bog at north end of Cameron Lake.

E. **viridicarinatum** (Engelm.) Fern. Bog in beaver pond area, vicinity of Sofa Mountain.

Kobresia simpliciuscula (Wahl.) Mack. var. **americana** Duman Boggy edge of beaver pond in vicinity of Sofa Mountain.

Scirpus caespitosus L. var. **callosus** Bigel. (*S. caespitosus* subsp. *austriacus* (Pall.) Aschers. & Graebn.) Bog in beaver pond area, vicinity of Sofa Mountain.

S. **validus** Vahl Common in shallow water of Maskinonge Lake at low elevation.

JUNCACEAE

Juncus alpinus Vill var. *rariflorus* Hartm. (*J. richardsonianus* Schultes) Boggy edge of beaver pond, vicinity of Sofa Mountain.

J. **balticus** Willd. var. **montanus** Engelm. (*J. ater* Rydb.) Occasional in moist meadows at lower elevations.

J. **balticus** var. **vallicola** Rydb. (*J. vallicola* Rydb.) Forming a zone around a small lake near east park entrance.

J. **bufonius** L. Muddy shore of beaver pond in vicinity of Sofa Mountain.

J. **confusus** Coville Frequent in submontane fescue grassland, vicinity of Sofa Mountain.

J. **drummondii** E. Meyer Frequent in subalpine meadows.

J. **ensifolius** Wikstr. Wet shores of lakes and streams at lower elevations.

J. **longistylis** Torr. Occasional in damp meadows at low and middle elevations.

J. **mertensianus** Bong. Boggy opening in coniferous woods near Cameron Lake at middle elevation.

J. nodosus L. Bogs and muddy shores at lower elevations.

J. parryi Engelm. Grassy slopes near timberline at Bertha Lake.

J. saximontanus A. Nels. Common along shores and in bogs at low and middle elevations.

J. tenuis Willd. var. **dudleyi** (Wieg.) Hermann (*J. dudleyi* Wieg.) Frequent in damp meadows and shores at lower elevations.

Luzula glabrata (Hoppe) Desv. (*Juncoides glabratum* (Hoppe) Sheldon) Common in subalpine meadows and rock slides above timberline.

L. intermedia (Thuill.) Spenner (*L. campestris* (L.) DC var. *multiflora* (Retz.) Celak.; *J. intermedium* (Thuill.) Rydb.) Occasional in dry pine woods, moist thickets and fescue prairie in vicinity of Sofa Mountain. Specimens distributed as *L. campestris* belong here.

L. parviflora (Ehrh.) Desv. (*J. parviflorum* (Ehrh.) Cov.) Frequent in moist coniferous woods at middle elevations.

L. piperi (Cov.) M. E. Jones (*J. piperi* Cov.) Occasional in wet spruce woods and open meadows at middle elevation; Cameron Lake and east slope of Sofa Mountain.

L. spicata (L.) DC. (*J. spicatum* (L.) Kuntze) Frequent on exposed alpine slopes.

LILIACEAE

Allium cernuum Roth (*A. recurvatum* Rydb.) Frequent on prairie and grassy slopes at low and middle elevations.

A. geyeri S. Wats. var. **tenerum** M. E. Jones (*A. rubrum* Osterh.; *A. fibrosum* Rydb.; *A. rydbergii* Macbr.) On moist grassy, south-facing slope of Mt. Glendowan at middle elevation. Flowers mostly replaced by bulblets.

A. schoenoprasum L. var. **sibiricum** (L.) Hartm. (var. *laurentianum* Fern.; *A. sibiricum* L.) Occasional along streams at low and middle elevations.

A. textile Nelson & Macbr. Frequent on prairie at lower elevations.

Calochortus apiculatus Baker Common on dry, sparsely wooded slopes at lower elevations.

Clintonia uniflora (Schult.) Kükenth. Common in coniferous woods at low and middle elevations.

Disporum hookeri (Torr.) Britt. var. **oregonum** (S. Wats.) Q. Jones (*D. oregonum* (S. Wats.) Benth. & Hook.) Frequent in coniferous woods at lower and middle elevations.

D. trachycarpum (S. Wats.) Benth. & Hook. Occasional in coniferous woods; Blakiston Brook and Crypt Lake.

Erythronium grandiflorum Pursh (*E. parviflorum* (S. Wats.) Gooding; *E. obtusatum* Gooding) Common in the alpine zone where patches of snow remain until late in summer.

Lilium philadelphicum L. var. **andinum** (Nutt.) Ker. (*L. umbellatum* Pursh; *L. montanum* A. Nels.) Occasional in moist prairie and edge of aspen woods, vicinity of Sofa Mountain.

Smilacina racemosa (L.) Desf. var. **amplexicaulis** (Nutt.) S. Wats. (*S. amplexicaulis* Nutt.; *Vagnera amplexicaulis* (Nutt.) Morong) Occasional in coniferous woods extending from lower elevations to timberline.

S. stellata (L.) Desv. (*Vagnera stellata* (L.) Morong; *S. sessilifolia* Baker) Frequent in woods, thickets, meadows and grassy slopes at lower elevations.

Stenanthium occidentale A. Gray (*Stenanthella occidentalis* (A. Gray) Rydb.) Common in coniferous woods from lower elevations to timberline.

Streptopus amplexifolius (L.) DC. Along brook in spruce woods, vicinity of Sofa Mountain.

Tofieldia glutinosa (Michx.) Pers. var. MONTANA (C. L. Hitchc.) Breitung, comb. nov. (*T. glutinosa* subsp. *montana* C. L. Hitchc., Amer. Midl. Nat. 42: 496, 1947; *T. intermedia* Rydb., in part) Boggy shore of Summit Lake near timberline.

Veratrum viride Ait. var. ESCHSCHOLTZII (A. Gray) Breitung, stat. nov. (*V. eschscholtzii* A. Gray, Ann. Lyc. Nat. Hist. N.Y. 4: 119, 1837; *V. escholtzianum* (Roem. & Schult.) Rydb.) Common in moist woods and avalanche slides from lower elevations to timberline.

Xerophyllum tenax (Pursh) Nutt. Abundant in open woods and slopes from middle elevations to timberline.

Zygadenus elegans Pursh (*Z. chloranthus* Richards.; *Anticlea elegans* (Pursh) Rydb.; *A. alpina* (Blankinship) Heller) Frequent on moist prairie at lower elevations and occasional on grassy slopes at timberline.

Z. venosus (Nutt.) S. Wats. var. **gramineus** (Rydb.) Walsh (*Z. gramineus* Rydb.; *Z. intermedius* Rydb.; *Anticlea gramineus* Rydb.; *Toxicoscordion gramineum* Rydb.) Occasional on moist depressions in prairie near east park boundary.

IRIDACEAE

Sisyrinchium montanum Greene (*S. angustifolium* of western auth., not Mill.) Frequent on prairie near east park boundary.

ORCHIDACEAE

Calypso bulbosa (L.) Oakes (*C. borealis* Salisb.; *Cytheria bulbosa* (L.) House) Dry pine woods in vicinity of Sofa Mountain at middle elevation.

Corallorhiza maculata Raf. (*C. multiflora* Nutt.) Dry pine woods in vicinity of Sofa Mountain at middle elevation.

C. striata Lindl. Moist spruce woods near brook, vicinity of Sofa Mountain at middle elevation.

C. trifida Châtelain (*C. corallorhiza* (L.) Karst) In coniferous woods at north end of Cameron Lake, middle elevation.

Cypripedium montanum Dougl. In wet spruce woods, vicinity of Sofa Mountain at middle elevation. Also noted along trail to Crypt Lake.

C. passerinum Richards. Found in two localities, edge of swamp and moist spruce woods, 1 and 2 miles north of the international boundary, vicinity of Sofa Mountain.

Goodyera oblongifolia Raf. (*Peramium decipiens* (Hook.) Piper; *P. menziesii* (Lindl.) Morong) Common in dry coniferous woods at lower elevations.

Habenaria dilatata (Pursh) Hook. (*Limnorchis dilatata* (Pursh) Rydb.) Frequent on wet shores and swampy woods at low elevations.

H. hyperborea (L.) R. Br. (*L. viridiflora* (Cham.) Rydb.) Common in swamps and on shores at low elevations.

H. obtusata (Pursh) Richards. (*Lysiella obtusata* (Pursh) Rydb.) Wet spruce woods in vicinity of Sofa Mountain.

H. saccata Greene (*H. stricta* Rydb., not A. Rich. & Gal., nor Ridley; *Limnorchis stricta* Rydb.) Springy place in coniferous woods at north end of Cameron Lake.

H. unalascensis (Spreng.) S. Wats. (*Piperia unalascensis* (Spreng.) Rydb.) Occasional in dry pine woods at middle elevations.

H. viridis (L.) R. Br. var. **bracteata** (Muhl.) A. Gray (*Coeloglossum bracteatum* (Muhl.) Parl; *H. viridis* subsp. *bracteata* (Muhl.) R. T. Clausen) Occasional in borders of aspen woods at lower and middle elevations; Sofa Mountain.

Listera caurina Piper (*Ophrys caurina* (Piper) Rydb.) Occasional in moist coniferous woods at middle elevations.

L. cordata (L.) R. Br. (*O. cordata* L.; *O. nephrophylla* Rydb.) Occasional in wet coniferous woods at middle elevations.

Orchis rotundifolia Banks Moist spruce woods near brook in vicinity of Sofa Mountain.

Spiranthes romanzoffiana Cham. & Schl. (*Ibidium strictum* (House) Rydb.) Occasional in boggy meadows and wet shores at lower elevations.

SALICACEAE

Populus tremuloides Michx. Common along streams and forming scattered groves of trees on prairie at lower elevations, extending sparingly to middle elevations.

P. trichocarpa Torr. & Gray var. **hastata** (Dode) Henry (*P. hastata* Dode) Common along margins of streams at lower elevations.

Salix arctica Pall. var. **araioclada** (Schn.) Raup (*S. anglorum* Cham. var. *araioclada* Schn.; *S. petrophila* Rydb.) Common in alpine meadows near snow banks.

S. bebbiana Sarg. var. **perrostrata** (Rydb.) Schn. Common in river valleys at low elevations. The pubescent-leaved typical form of the species likely occurs also.

S. brachycarpa Nutt. (*S. stricta* Rydb.) Occasional in open boggy places in coniferous woods on east slope of Sofa Mountain and on open south-facing slope of Vimy Ridge near Crypt Lake where it was found at 6,500 feet elevation.

S. candida Flügge Bog in beaver pond area in vicinity of Sofa Mountain.

S. caudata (Nutt.) Heller var. **parvifolia** Ball Shore near Waterton River bridge.

S. **commutata** Bebb Frequent in subalpine meadows and in boggy area at north end of Cameron Lake.

S. **discolor** Muhl. var. **prinoides** (Pursh) Schn. (*S. prinoides* Pursh) Common on shore of Waterton Lake.

S. **drummondiana** Barratt Common along margins of streams and lakes at upper elevations; Bertha Lake.

S. **drummondiana** var. **bella** (Piper) Ball (*S. bella* Piper) Waterton Lakes National Park: Alt. 4,200 and 5,000 feet, respectively, *Malte & Watson, Nos. 116759 (257), 116764 (341)* in 1925. See: Ball in Amer. Midl. Nat. 45: 744, 1951. Of the 8 collection numbers made in the park by the writer, all have proved to be typical *S. drummondiana* or the following var. *subcoerulea.* The variety *bella* appears to be merely a narrow-leaved phase of *S. drummondiana* which is further indicated by their apparently coinciding ranges, whereas var. *subcoerulea* is readily distinguished by its pruinose branchlets and by the different indument on the undersurfaces of the leaves together with a more extensive distribution south and north of typical *S. drummondiana.*

S. **drummondiana** var. **subcoerulea** (Piper) Ball (*S. pachnophora* Rydb.; *S. covillei* Eastwood; *S. pellita* of western auth., not Anderss.) Common along streams and lake shores at low and middle elevations; Belly River, Waterton Lake and Cameron Lake.

S. **farrae** Ball Occasional in boggy, birch-willow thickets on east slope of Sofa Mountain.

S. **glauca** L. (*S. glaucops* Anderss.; *S. seemannii* Rydb.; *S. pseudolapponum* von Seemen; *S. nudescens* Rydb.) Occasional in bog near beaver pond in vicinity of Sofa Mountain and at timberline around Carthew Lakes.

S. **interior** Rowlee var. **pedicellata** (Anderss.) Ball (*S. linearifolia* Rydb.) Thicket-forming shrub along Waterton River.

S. **lasiandra** Benth. (*S. lyallii* (Sarg.) Heller) Several trees, 25 feet high, were found in wet poplar woods near Waterton River ranger station.

S. **lutea** Nutt. On gravelly shore of Belly and Waterton Rivers.

S. **maccalliana** Rowlee Occasional in swampy places, beaver pond area in vicinity of Sofa Mountain.

S. **mackenzieana** (Hook.) Barratt Frequent along streams at low elevations; Waterton and Belly Rivers. Capsules slender-pedicelled.

S. **melanopsis** Nutt. Frequent along the Waterton and Belly Rivers.

S. **myrtillifolia** Anderss. Boggy places in beaver pond area vicinity of Sofa Mountain. Depressed shrub 4 to 12 inches high or sometimes 2 or 3 feet high.

S. **padophylla** Rydb. (*S. pseudomonticola* Ball) Occasional in Waterton and Belly River valleys at low elevations. See: Check list of native and naturalized trees of the United States, including Alaska, Agriculture Handbook 41, U. S. Dept. Agr. 392, 1953.

S. **planifolia** Pursh Frequent along river and lake shores at low elevations.

S. **pseudocordata** (Anderss.) Rydb. (*S. monochroma* Ball) Common along shores at low elevations.

S. **reticulata** L. var. **nivalis** (Hook.) Kelso (*S. nivalis* Hook.) Common on alpine mountain summits.

S. **reticulata** var. **saximontana** (Rydb.) Kelso (*S. saximontana* Rydb.; *S. nivalis* var. *saximontana* (Rydb.) Schn.) Alpine slope on Sofa Mountain.

S. **scouleriana** Barratt Frequent in thin coniferous woods at lower and middle elevations.

S. **serissima** (Bailey) Fern. (*S. erythrocoma* Barratt; *S. lucida* of western auth., not Muhl.) Occasional in boggy places in beaver pond area, vicinity of Sofa Mountain.

S. **vestita** Pursh var. **erecta** Anderss. (*S. fernaldii* Blankinship) Occasional on wet ledges and open slopes near brooks at timberline; Mt. Rowe, Sofa Mountain and Crypt Lake.

BETULACEAE

Alnus crispa (Ait.) Pursh var. SINUATA (Regel) Breitung, comb. nov. (*A. viridis* var. *sinuata* Regel ex DC. Prod. 26: 183, 1868; *A. sinuata* (Regel) Rydb.; *A. crispa* subsp. *sinuata* (Regel) Hultén; *A. sitchensis* Sarg.) Frequent on moist slopes, especially avalanche slides at low and middle elevations.

A. **incana** (L.) Moench var. **virescens** S. Wats. (*A. tenuifolia* Nutt.) Occasional in the Belly River valley; trees 25 feet high.

Betula occidentalis Hook. (*B. fontinalis* Sarg.; *B. microphylla* Bunge var. *fontinalis* (Sarg.) M. E. Jones) Common along streams at lower elevations. Shrub or small tree in clumps, 10 to 25 feet high; bark dark bronze, not separating into layers.

B. papyrifera Marsh. var. **subcordata** (Rydb.) (Sarg. (*B. subcordata* Rydb.) Occasional along bank of Waterton Lake at lower elevation. Not observed elsewhere in the park area. Tree up to 30 feet high, bark white or orange-brown, readily peeling into layers.

B. pumila L. var. **glandulifera** Regel (*B. glandulifera* (Regel) Butler; *B. hallii* Howell) Frequent in bogs at beaver pond area in vicinity of Sofa Mountain.

URTICACEAE

Urtica lyallii S. Wats. Frequent in moist thickets at low and middle elevations.

SANTALACEAE

Comandra umbellata (L.) Nutt. var. **pallida** (A. DC.) M. E. Jones (*C. pallida* A. DC.) Occasional on dry prairie near east park boundary at low elevation.

POLYGONACEAE

Eriogonum androsaceum Benth. (*E. flavum* Nutt. var. *androsaceum* (Benth.) G. N. Jones) Occasional on alpine summits of high mountains.

E. flavum Nutt. Frequent on dry exposed prairie hilltops near east park boundary and prairie along Blakiston Brook.

E. heracleoides Nutt. var. **subalpinum** (Greene) Stokes (*E. subalpinum* Greene; *E. umbellatum* Torr. subsp. *majus* Benth.) Frequent on exposed rocky slopes at lower elevations.

E. ovalifolium Nutt. var. **depressum** Blankinship (*E. depressum* (Blankinship) Rydb.) Frequent on exposed alpine slopes.

E. piperi Greene (*E. flavum* subsp. *piperi* (Greene) Stokes; *E. flavum* var. *piperi* (Greene) G. N. Jones) Common on shale slides above timberline forming circular matts up to 2 feet across.

Oxyria digyna (L.) Hill Common along brooks and on wet ledges extending from middle elevations to alpine summits.

Polygonum achoreum Blake Introduced roadside weed near east park entrance.

P. amphibium L. var. **stipulaceum** (Coleman) Fern. forma **hirtuosum** (Farw.) Fern. Marshy sedge meadow around pond near Waterton River bridge; probably not rare.

P. amphibium var. **stipulaceum** forma **fluitans** (A. Eaton) Fern. (*P. natans* (Michx.) A. Eaton) In pond on south side of road near east park entrance.

P. aviculare L. var. **littorale** (Link) W. D. J. Koch (*P. buxiforme* Small) Introduced weed along sidewalk in Waterton.

P. bistortoides Pursh (*Bistorta bistortoides* (Pursh) Small) Moist depressions in submontane prairie near Lookout Butte and on alpine summit of Sofa Mountain.

P. convolvulus L. (*Bilderdykia convolvulus* (L.) Dum.) Among shrubbery on bank of Waterton River near bridge; introduced annual.

P. douglasii Greene Occasional on brushy hillsides at low and middle elevations.

P. engelmannii Greene Eroded east bank of Lonesome Lake; scarce.

P. lapathifolium L. (*Persicaria lapathifolia* (L.) S. F. Gray) On beaver dam near Lookout Butte; scarce.

P. minimum S. Wats. Shore of Bertha Lake at upper elevation; scarce.

P. viviparum L. (*Bistorta vivipara* (L.) S. F. Gray) Around bogs at middle elevations; north end of Cameron Lake and in beaver pond area near Lookout Butte.

Rumex acetosella L. Roadside in open pine woods near Cameron Lake; introduced.

R. alpestris (Scop.) Löve Frequent in moist depressions on fescue grassland near Lookout Butte. Specimens distributed as *R. acetosa*. See: Rhodora 59: 1-5, 1957.

R. crispus L. Established in marshes and along roadsides in Waterton River valley.

R. maritimus L. var. **fueginus** (Phil.) Dusén (*R. persicarioides* L.) On beaver dam near Lookout Butte.

R. occidentalis S. Wats. (*R. fenestratus* Greene) Occasional in wet meadows and marshes at lower elevations.

CHENOPODIACEAE

Chenopodium album L. On cut bank at Waterton Park village; introduced.

C. capitatum (L.) Aschers. (*Blitum capitatum* L.) Along roadside to Cameron Lake, *J. J.*

Sexsmith, July 15, 1937 (DAL).

C. humile Hook. (*C. rubrum* L. var. *humile* (Hook.) S. Wats.) On mud in dried-up pond near Lookout Butte.

Monolepis nuttalliana (Schult.) Greene Weed in disturbed places, roadsides and vacant lots at Waterton Park village.

Salsola kali L. var. **tenuifolia** Tausch (*S. pestifer* A. Nels.) Roadside near north park entrance.

AMARANTHACEAE

Amaranthus graecizans L. (*A. blitoides* S. Wats.) Introduced weed along sidewalks and edge of gravel pits.

PORTULACACEAE

Claytonia lanceolata Pursh Common in subalpine meadows near snow banks.

C. megarrhiza (A. Gray) Parry Occasional on shale slopes and alpine summits.

C. parvifolia Moq. (*Naiocrene parvifolia* (Moq.) Rydb.; *Montia parvifolia* (Moq.) Greene) Occasional on wet rocks and ledges near waterfalls at middle and upper elevations.

Lewisia pygmaea (A. Gray) Robinson (*Oreobroma pygmaea* (A. Gray) Howell) Alpine summit of Sofa Mountain; rare.

CARYOPHYLLACEAE

Arenaria capillaris Poir. var. **americana** (Maguire) Davis (*A. capillaris* subsp. *americana* Maguire; *A. formosa* of Amer. auth., not Fisch.) Common on alpine and subalpine slopes, also in submontane fescue grassland near Lookout Butte at lower elevation.

A. lateriflora L. (*Moehringia lateriflora* (L.) Fenzl) Occasional in moist woods at lower elevations.

A. nuttallii Pax (*Alsinopsis occidentalis* Heller) Common on shale slides and alpine summits.

A. obtusiloba (Rydb.) Fern. (*A. laricifolia* of Amer. auth., not L.) Common on alpine slopes and on dry windswept hilltop near north park entrance.

A. rossii R. Br. var. **apetala** Maguire Frequent on exposed rocky alpine slopes.

A. rubella (Wahl.) J. E. Smith (*A. propinqua* Richards.; *Alsinopsis propinqua* (Richards.) Rydb.) Frequent on exposed slopes extending from lower elevations to alpine mountain tops.

A. sajanensis Willd. Occasional in alpine and subalpine meadows; Sofa Mountain, Carthew Lakes.

Cerastium arvense L. (*C. strictum* L.; *C. campestre* Greene) Frequent on prairie near east park boundary.

C. beeringianum Cham. & Schlecht. Common on alpine summits and shale slides.

Paronychia sessiliflora Nutt. Frequent on dry exposed prairie hilltops.

Lychnis drummondii (Hook.) S. Wats. (*Silene drummondii* Hook.; *Wahlbergella drummondii* (Hook.) Rydb.; *Melandrium drummondii* (Hook.) A. E. Porsild) Prairie in Belly River valley; scarce.

Sagina saginoides (L.) Britton (*S. linnaei* Presl) Frequent in wet subalpine meadows.

Silene acaulis L. var. **exscapa** (All.) DC. Common on alpine summits.

S. menziesii Hook. (*Anotites viscosa* Greene, *A. tereticaulis* Greene) In aspen woods at lower elevations; vicinity of Sofa Mountain.

S. parryi (S. Wats.) Hitchc. & Maguire (*S. macounii* S. Wats.) Frequent on talus slopes at timberline and occasional on grassy slopes extending down to lower elevations.

Stellaria alpestris Fries (*Alsine alpestris* (Fries) Rydb.) In aspen woods along Waterton River.

S. americana Porter (*A. americana* (Porter) Rydb.) South-facing alpine slope near summit of Sofa Mountain. New to Canada.

S. crassifolia Ehrh. (*A. crassifolia* (Ehrh.) Britton) Edge of beaver pond in vicinity of Sofa Mountain.

S. crispa Cham. & Schlecht. (*A. crispa* (Cham. & Schlecht.) Holz) In springy place near Cameron Lake. Also noted along Rowe Creek at middle elevation.

S. laeta Richards. (*A. laeta* (Richards.) Rydb.) Occasional on rocky alpine summits.

S. longifolia Muhl. (*A. longifolia* (Muhl.) Britton) Occasional in wet woods at lower elevations.

S. longipes Goldie (*A. longipes* (Goldie) Coville) Frequent in damp meadows at lower elevations.

S. media (L.) Cyrill *(A. media* L.) In wet woods along Blakiston Brook near beaver pond; introduced.

S. umbellata Turcz. *(A. baicalensis* Coville) On exposed slopes above Lower Rowe Lake.

RANUNCULACEAE

Actaea rubra (Ait.) Willd. var ARGUTA (Ntt.) Breitung, comb. nov. *(A. arguta* Nutt. ex Torr. & Gray, Fl. N. Amer. 1: 35, 1838; *A. spicata* L. var. *arguta* (Nutt.) Torr.; *A. rubra* subsp. *arguta* (Nutt.) Hultén) Frequent in coniferous woods. Red- and white-fruited forms occur.

Anemone cylindrica A. Gray Frequent on moist prairie near east park boundary.

A. drummondii S. Wats. Common on alpine and subalpine slopes.

A. multifida Poir. var. **globosa** (Nutt.) A. Gray *(A. globosa* Nutt.; *A. tetonensis* Porter; *A. lithophila* Rydb.) Frequent on alpine and subalpine slopes. Flowers blue on the outside and ochroleucous within.

A. multifida var. **richardsiana** Fern. Frequent on prairie near east park boundary. Flowers purple to cream.

A. occidentalis S. Wats. *(Pulsatilla occidentalis* (S. Wats.) Freyn) Occasional in subalpine meadows; Rowe Creek, Goat Lake, Carthew Lakes.

A. parviflora Michx. Occasional in wet meadows at middle and upper elevations.

A. patens L. var. **wolfgangiana** (Bess.) Koch *A. patens* var. *multifida* Pritzel; *A. patens* var. *nuttalliana* A. Gray; *Pulsatilla ludoviciana* (Nutt.) Heller; *P. hirsutissima* Britton) Common on prairie and grassy slopes extending to timberline.

Aquilegia flavescens S. Wats. (*A. formosa* Fisch. var. *flavescens* (S. Wats.) Frye & Rigg) Common on open slopes at middle and upper elevations.

A. jonesii Parry Occasional on alpine summits. Plants 2 to 5 cm. high; flowers blue to purple. Mt. Crandell, Sofa Mountain and trail to Crypt Lake.

Clematis ligusticifolia Nutt. Woody vine climbing over thickets along the Waterton River; occasional.

C. verticellaris DC. var. **columbiana** (Nutt.) A. Gray *(C. columbiana* (Nutt.) Torr. & Gray; *Atragene columbiana* Nutt.; *A. grosseserrata* Rydb.) Occasional in coniferous woods from lower to upper elevations.

Delphinium bicolor Nutt. Grassy slopes at low elevations. Past flowering when writer arrived in park, therefore relative abundance could not be determined.

D. bicolor forma **montanense** (Rydb.) Ewan Frequent on shale slides above timberline.

Ranunculus abortivus L. Moist thickets at north end of Waterton Lake.

R. acris L. Frequent on flood plain meadows of the Waterton River valley.

R. aquatilis L. var. **subrigidus** (W. Drew) Breitung *(R. subrigidus* W. Drew; *R. circinatus* Sibth. var. *subrigidus* (W. Drew) L. Benson) Occasional in shallow lakes and slow streams.

R. cardiophyllus Hook. (*R. pedatifidus* J. E. Smith var. *cardiophyllus* (Hook.) Britton; *R. affinis* R. Br. var. *cardiophyllus* (Hook.) A. Gray) Frequent in grassland, vicinity of Sofa Mountain.

R. cymbalaria Pursh *(Halerpestes cymbalaria* (Pursh) Greene) Wet meadow in beaver pond area, vicinity of Sofa Mountain.

R. eschscholtzii Schlecht. Common in subalpine meadows and talus slopes.

R. flammula L. var. **filiformis** (Michx.) Hook. *(R. filiformis* Michx.) On muddy shore of pond near Waterton River crossing.

R. flammula var. **ovalis** (Bigel.) L. Benson (*R. repens* L. var. *ovalis* (Bigel.) Torr. & Gray; *R. unalaschensis* Besser) Occasional on shores of ponds and lakes at low elevations.

R. gmelinii DC. var. **hookeri** (D. Don) L. Benson *(R. purshii* Richards.) Muddy shores of beaver ponds in vicinity of Sofa Mountain.

R. inamoenus Greene In moist meadow at Waterton Park village; probably not rare.

R. macounii Britton Occasional in moist meadows at low elevations.

R. sceleratus L. Occasional on marshy shores of lakes and streams at low elevations.

R. uncinatus D. Don var. **parviflorus** (Torr.) L. Benson (*R. bongardii* Greene) Occasional in coniferous woods at middle elevations; Bertha Creek and Cameron Lake.

Thalictrum dasycarpum Fisch. & Lall. (*T. hypoglaucum* Rydb.) Occasional in damp meadows at Maskinonge and Waterton Lakes.

T. occidentale A. Gray (*T. megacarpum* Torr.) Frequent in open woods and grassy slopes from middle elevations to timberline.

T. venulosum Trelease (*T. columbianum* Rydb.) Occasional on low prairie near east park boundary.

Trollius albiflorus (A. Gray) Rydb. Common in wet subalpine meadows.

BERBERIDACEAE

Berberis repens Lindl. (*Mahonia repens* (Lindl.) G. Don) Occasional in dry coniferous woods. Flowers yellow; fruit blue.

PAPAVERACEAE

Papaver pygmaeum Rydb. Occasional on shale slides and alpine summits; Mt. Carthew, Mt. Newman and Sofa Mountain.

CRUCIFERAE

Alyssum alyssoides L. Dry eroded hillside on east end of Lonesome Lake and roadside east of Waterton Park village; introduced.

Arabis divaricarpa A. Nels. (*A. brachycarpa* (Torr. & Gray) Britton; *A. bourgovii* Rydb.) Occasional on dry river banks and exposed hillsides at low and middle elevations; Belly River and Cameron Lake.

A. drummondii A. Gray Occasional on open slopes at middle and upper elevations.

A. glabra (L.) Bernh. (*Turritis glabra* L.) Open spruce and pine woods near Lookout Butte.

A. hirsuta (L.) Scop. var **pycnocarpa** (Hopkins) Rollins (*A. ovata* (Pursh) Poir.) Frequent on moist prairie at low and middle elevations.

A. holboellii Hornem. var. **retrofracta** (Graham) Rydb. (*A. retrofracta* Graham) Occasional on dry banks at low and middle elevations.

A. lemmonii S. Wats. Occasional on talus slopes and mountain summits.

A. lyallii S. Wats. Frequent on alpine slopes and summits.

A. lyrata L. var. **kamchatica** Fisch. Rocky slope above Lower Rowe Lake and along Bertha Creek in coniferous forest at middle and upper elevations.

A. nuttallii Robinson On talus slopes at Carthew Lakes and at Goat Lake in the subalpine zone.

Cardamine pensylvanica Muhl. Occasional in bogs and marshes at lower and middle elevations.

Capsella bursa-pastoris (L.) Medic (*Bursa bursa-pastoris* (L.) Weber) Introduced weed at Waterton Park village.

Descurainia pinnata (Walt.) Britton var. **brachycarpa** (Richards.) Fern. (*Sisymbrium brachycarpum* Richards.; *Sophia brachycarpa* (Richards.) Rydb.; *D. pinnata* subsp. *brachycarpa* (Richards.) Detling) Edge of gravel pit north of Waterton River.

D. richardsonii (Sweet) O. E. Schulz (*Sophia richardsoniana* (Sweet) Rydb.) Occasional on dry banks and hillsides at lower elevations.

D. richardsonii var. PROCERA (Greene) Breitung, comb. nov. (*Sophia procera* Greene, Pittonia 4: 199, 1900; *D. richardsonii* subsp. *procera* (Greene) Detling). Moist roadside near Cameron Lake and open south-facing slope along Rowe Creek.

D. sophia (L.) Webb (*Sisymbrium sophia* L.; *Sophia sophia* (L.) Britton; *S. parviflora* (Lam.) Standl.) Introduced weed along roadsides and disturbed ground.

Diplotaxus muralis (L.) DC. Disturbed ground on hillside, north end of Maskinonge Lake; introduced.

Draba aurea Vahl Frequent on dry banks and open slopes at middle and upper elevations.

D. crassifolia Grah. Occasional on alpine summits and exposed slopes.

D. incerta Payson Occasional on shale slides and exposed alpine summits.

D. lonchocarpa Rydb. Alpine slopes above Carthew Lakes; probably not rare.

D. nemorosa L. Disturbed ground at Waterton Park village.

D. paysonii Macbr. var. **treleasii** (Schulz) C. L. Hitchc. (*D. densifolia* of most authors, not Nutt.) Frequent on exposed alpine slopes and windswept summits.

D. praealta Greene Occasional on subalpine slopes; Rowe Lakes and Bertha Lake.

Erysimum cheiranthoides L. (*Cheirinia cheiranthoides* (L.) Link) In thickets along the Waterton River at low elevations.

E. inconspicuum (S. Wats.) MacMill. (*C. inconspicua* (S. Wats.) Rydb.) Occasional on prairie near east park boundary.

Lepidium densiflorum Schrad. Introduced weed along roadsides.

Lesquerella arenosa (Richards.) Rydb. Dry eroded hillside on prairie near east park entrance.

Neslia paniculata (L.) Desv. Introduced along roadsides and cut banks at Waterton Park village.

Physaria didymocarpa (Hook.) A. Gray Frequent on dry exposed slopes extending from lower elevations to mountain summits.

Rorippa islandica (Oeder) Borbas var. **hispida** (Desv.) Butters & Abbé (*Radicula hispida* (Desv.) Britton) Occasional on wet shores and in marshes at lower elevations.

Sisymbrium altissimum L. (*Norta altissima* (L.) Britton) Introduced weed along roadsides and in waste places.

Smelowskia calycina (Desv.) C. A. Meyer var. **americana** (Rydb.) Drury & Rollins (*S. americana* Rydb., *S.leariloba* Rydb.) Common on shale slides and alpine summits.

Thlaspi arvense L. Introduced weed along roadsides.

CRASSULACEAE

Sedum douglasii Hook. Frequent on river bars and dry exposed rocky slopes at low and middle elevations.

S. roseum (L.) Scop. var. **integrifolium** (Raf.) Berger (*Rhodiola integrifolia* Raf.; *R. rosea* L. var. *integrifolia* (Raf.) Jepson; *S. roseum* subsp. integrifolium (Raf.) Hultén) Occasional on rocky alpine slopes.

S. stenopetalum Pursh Common on exposed grassy slopes at low and middle elevations.

SAXIFRAGACEAE

Hemieva ranunculifolia (Hook.) Raf. (*Saxifraga ranunculifolia* Hook.; *Boykinia ranunculifolia* (Hook.) A. Gray; *Suksdorfia ranunculifolia* (Hook.) Engler) On moist slopes at middle and upper elevations; Crypt Lake, Bertha Lake and Mt. Glendowan.

Heuchera cylindrica Dougl. var. **glabella** (Torr. & Gray) Wheelock (*H. glabella* Torr. & Gray) Common on exposed grassy slopes extending from lower elevations to timberline.

H. flabellifolia Rydb. Occasional on dry hills in prairie near east park boundary.

Leptarrhena pyrolifolia (D. Don) R. Br. Occasional in boggy subalpine meadows; Cameron Lake, Summit Lake and Goat Lake.

Lithophragma bulbifera Rydb. Moist rocky slope in cirque of Mt. Rowe.

Mitella breweri A. Gray (*Pectianthia breweri* (A. Gray) Rydb.) Occasional in moist coniferous forest at upper elevations.

M. nuda L. Occasional in moist spruce woods at lower elevations; Bauerman Brook and Lookout Butte.

M. pentandra Hook. (*Pectianthia pentandra* (Hook.) Rydb.) Frequent along brooks in coniferous forest at middle and upper elevations.

M. violacea Rydb. (*Ozomelis violacea* Rydb.) Occasional along springs in coniferous forest at middle and upper elevations.

Parnassia fimbriata Konig Frequent in bogs and along springs in coniferous forest at middle and upper elevations.

P. kotzebuei Cham. Along brook at Carthew Lakes above timberline.

P. montanensis Fern. & Wieg. Common along streams and in bogs at lower and middle elevations.

Ribes divaricatum Dougl. var. **inerme** (Rydb.) McMinn (*R. inerme* Rydb.; *R. vallicola* Greene; *Grossularia inermis* (Rydb.) Cov. & Britton) Frequent on rocky slopes at lower elevations.

R. lacustre (Pers.) Poir. (*Limnobotrya lacustris* (Pers.) Rydb.) Frequent in moist coniferous woods at middle and upper elevations.

R. oxyacanthoides L. (*Grossularia oxyacanthoides* (L.) Mill.) Dry bank along Cameron Creek; scarce.

R. viscosissimum Pursh Occasional in coniferous woods at middle elevations.

Saxifraga **adscendens** L. var. OREGONENSIS (Raf.) Breitung, comb. nov. (*Ponista oregonensis* Raf., Fl. Tell. 2: 66, 1836; *S. oregonensis* (Raf.) A. Nels.; *S. adscendens* subsp. *oregonensis* (Raf.) Bacigalupi) Moist rocky slope above lower Rowe Lake.

S. bronchialis L. var. **austromontana** (Wieg.) M. E. Peck (*S. austromontana* Wieg.; *S. bronchialis* subsp. *austromontana* (Wieg.) Piper; *Leptasea austromontana* (Wieg.) Small) Common on rocky alpine slopes.

S. caespitosa L. (*Muscaria caespitosa* (L.)

Haw.) Frequent on alpine mountain tops.

S. cernua L. Occasional on alpine slopes and exposed summits.

S. ferruginea Graham (*S. bongardii* Presl; *S. brunoniana* Bong.; *Spatularia ferruginea* (Graham) Small) Occasional on wet ledges near waterfalls; Bertha Lake and Carthew Lakes.

S. lyallii Engler (*Micranthes lyallii* (Engler) Small) Occasional along streams and on wet ledges in coniferous forest at middle and upper elevations.

S. mertensiana Bong. (*Heterisia mertensiana* (Bong.) Small) Frequent along brooks and on wet ledges in coniferous forest and upper elevations.

S. occidentalis S. Wats. (*Micranthes occidentalis* (S. Wats.) Small) Common on alpine summits and extending down to middle elevations on grassy slopes.

Suksdorfia violacea A. Gray (*Hemieva violacea* (A. Gray) Wheelock) On wet mossy cliff near Cameron Falls, *W. C. McCalla,* June 1, 1941 (WCM). New to Canada.

Tiarella unifoliata Hook. Common in wet coniferous woods at middle and upper elevations.

HYDRANGEACEAE

Philadelphus lewisii Pursh On dry, rocky, south-facing lower slope of Mt. Crandell above road to Cameron Lake. Shrub 2 to 3 feet high.

ROSACEAE

Amelanchier alnifolia (Nutt.) Nutt. Common around aspen groves and on open hillsides at low and middle elevations.

Crataegus columbiana Howell On bank of the Waterton River near bridge.

C. douglasii Lindl. Occasional on river banks at low elevations.

Dryas drummondii Richards. Frequent on river bars at low elevations.

D. octopetala L. var. HOOKERIANA (Juz.) Breitung, comb. nov. (*D. hookeriana* Juz., Bull. Jard. Bot. Princip. U.R.S.S. 28: 325, 1929; *D. octopetala* subsp. *hookeriana* (Juz.) Hultén) Abundant on alpine slopes.

Fragaria vesca L. var. **bracteata** (Heller) Davis (*F. bracteata* Heller; *F. helleri* Holz) In thickets on south-facing slope along Bertha Creek.

F. virginiana Dcne. var. **glauca** S. Wats. (*F. glauca* (S. Wats.) Rydb.; *F. pauciflora* Rydb.) Common on low prairie and in aspen groves.

F. virginiana var. **platypetala** (Rydb.) Hall (*F. platypetala* Rydb.) Occasional on exposed alpine slopes and in subalpine meadows.

Geum allepicum Jacq. var. **strictum** (Ait.) Fern. (*G. strictum* Ait.; *G. allepicum* subsp. *strictum* (Ait.) R. T. Clausen) Occasional in damp thickets at low and middle elevations.

G. macrophyllum Willd. In damp spruce forest above Cameron Lake at middle elevation.

G. macrophyllum var. **perincisum** (Rydb.) Raup (*G. perincisum* Rydb.; *G. oregonense* Rydb., not Scheutz; *G. macrophyllum* subsp. *perincisum* (Rydb.) Hultén) Frequent in moist meadows and thickets at lower elevations.

G. rivale L. Occasional along springs in coniferous forest; Belly River valley.

G. triflorum Pursh var. **ciliatum** (Pursh) Fassett (*Sieversia ciliata* (Pursh) G. Don) Frequent on prairie at low elevations and exposed grassy slopes to timberline; Mt. Crandell.

Physocarpus malvaceus (Greene) Kuntze (*Opulaster malvaceus* (Greene) Kuntze) On rocky outcrops along east shore of Waterton Lake at Hell Roaring ranger cabin.

Potentilla anserina L. (*Argentina anserina* (L.) Rydb.) Wet meadow in vicinity of Sofa Mountain and shore of Waterton River.

P. arguta Pursh (*Drymocallis agrimonioides* (Pursh) Rydb.) Frequent in moist meadows at low and middle elevations.

P. bipinnatifida (Dougl. (*P. pensylvanica* L. var. *bipinnatifida* (Dougl.) Torr. & Gray) Frequent on dry prairie and exposed hillsides near east park boundary.

P. concinna Richards. Occasional on dry, exposed prairie hilltops near east park boundary.

P. diversifolia Lehm. (*P. glaucophylla* Lehm.; *P. dissecta* Nutt., not Pursh) Frequent in subalpine meadows and grassy alpine slopes.

P. effusa Dougl. Occasional on dry prairie near east park boundary.

P. flabelliformis Lehm. (*P. gracilis* Dougl. var. *flabelliformis* (Lehm.) Nutt.) Frequent in moist prairie at lower elevations.

P. fruticosa L. (*Dasiphora fruticosa* (L.) Rydb.) Frequent in submontane fescue grassland to windswept alpine summits where it is depauperate.

P. glandulosa Lindl. var. PSEUDORUPESTRIS (Rydb.) Breitung, comb. nov. (*P. pseudorupestris* Rydb., Bull. Torr. Club 24: 250, 1897; *Drymocallis pseudorupestris* (Rydb.) Rydb.; *P. glandulosa* subsp. *pseudorupestris* (Rydb.) Keck) Common on dry, open slopes at middle and upper elevations.

P. gracilis Dougl. var. NUTTALLII (Lehm.) Breitung, comb. nov. (*P. nuttallii* Lehm., Stirp. Pug. 9: 44, 1851; *P. rigida* Nutt., not Wall.; *P. viridescens* Rydb.; *P. jucunda* A. Nels.; *P. gracilis* subsp. *nuttallii* (Lehm.) Keck) Dry prairie near east park entrance, probably not uncommon.

P. hippiana Lehm. (*P. propinqua* Rydb.) Occasional on prairie near east park boundary.

P. macounii Rydb. Dry windswept prairie hilltop near north park entrance.

P. multisecta (S. Wats.) Rydb. (*P. pardissecta* Rydb.) Common on shale slides and alpine summits.

P. nivea L. Occasional on alpine summits and rocky slopes.

P. nivea var. **pentaphylla** Lehm. (*P. quinquefolia* Rydb.) Occasional on grassy slopes at middle and upper elevations.

P. ovina J. M. Macoun Common on exposed alpine summits.

P. pensylvanica L. (*P. strigosa* Rydb., not Pall.) Frequent on dry hills and prairie near east park boundary.

P. pentandra Engelm. (*P. rivalis* Nutt. var. *pentandra* (Engelm.) S. Wats.) Damp meadows along the Waterton River.

P. pulcherrima Lehm. (*P. gracilis* var. *pulcherrima* (Lehm.) Fern.; *P. filipes* Rydb.) Common on moist prairie near east park boundary.

P. rivalis Nutt. In damp meadows along the Waterton River.

P. saximontana Rydb. (*P. rubricaulis* Rydb., not Lehm.) Alpine summit of Sofa Mountain.

P. uniflora Ledeb. Common on exposed alpine mountain summits.

Prunus pensylvanica L.f. var. **saximontana** Rehder (*P. corymbulosa* Rydb.; *P. pensylvanica* subsp. *corymbulosa* (Rydb.) Wight) Occasional on open rocky slopes at low and middle elevations.

P. virginiana L. var. **melanocarpa** (A. Nels.) Sarg. (*P. melanocarpa* (A. Nels.) Rydb.) Occasional on river banks at low elevations.

Rosa acicularis Lindl. Frequent in open woods and banks at lower elevations.

R. arkansana Porter var. **suffulta** (Greene) Cockerell (*R. alcea* Greene) Common on dry hills and prairie near east park boundary.

R. woodsii Lindl. (*R. macounii* Greene) Common in aspen bluffs, thickets and on river banks at lower elevations.

Rubus acaulis Michx. In bogs around beaver ponds, vicinity of Sofa Mountain.

R. idaeus L. var. **aculeatissimus** Regel & Tiling (*R. melanolasius* Focke) Rock slide at foot of Mt. Crandell above road to Cameron Lake. Canes glaucous, armed with stiff, somewhat broad-based prickles.

R. idaeus var. **strigosus** (Michx.) Maxim. (*R. strigosus* Michx.) Occasional in open woods, thickets and on river banks; Belly River. Canes armed with slender terete bristles.

R. parviflorus Nutt. (*Rubacer parviflorum* (Nutt.) Rydb.) Common in coniferous woods at low and middle elevations.

R. pubescens Raf. (*R. triflorus* Richards.) Damp coniferous woods in Belly River valley.

Sibbaldia procumbens L. Frequent in subalpine meadows and alpine mountain summits.

Sorbus occidentalis (S. Wats.) Greene (*Pyrus occidentalis* S. Wats.) In coniferous woods around Bertha Lake near timberline.

S. scopulina Greene (*Pyrus sambucifolia* Porter, not Cham. & Schlecht.; *S. angustifolia* Rydb.) Frequent on wooded slopes at middle and upper elevations.

Spiraea densiflora Nutt. (*S. helleri* Rydb.) Occasional in subalpine meadows and swampy shores; Cameron Lake, Bertha Lake and Summit Lake.

S. lucida Dougl. (*S. betulifolia* Hook., not Pall.) Common in dry coniferous woods at low and middle elevations.

LEGUMINOSAE

Astragalus aboriginum Richards. (*Atelophragma aboriginum* (Richards.) Rydb.; *A. forwoodii* S. Wats.) Occasional on grassy slopes at lower elevations and extending to timberline or sometimes on alpine slopes.

A. agrestis Dougl. (*A. goniatus* Nutt.; *A. hypoglottis* Richards., not L.) In moist prairie near east park boundary.

A. alpinus L. (*Tium alpinum* (L.) Rydb.) Frequent on windswept mountain tops and occasional on river bars at low elevations.

A. americanus (Hook.) M. E. Jones (*Phaca americana* Hook.) Frequent in open coniferous woods at low and middle elevations.

A. bourgovii A. Gray (*Homalobus bourgovii* (A. Gray) Rydb.) Common in open subalpine woods and on shale slopes above timberline.

A. canadensis L. Along creek near north park entrance and bank of Lonesome Lake.

A. crassicarpus Nutt. var. **paysoni** (Kelso) Barneby (*A. succulentus* Richards. var *paysoni* Kelso; *A. prunifer* Rydb. On dry hillside in prairie near east park boundary; scarce. Plant with mature fruit; flowers not seen. R. C. Barneby informed me that he has examined collections of var. *paysoni* from Crow's Nest Pass, Alberta to the north and from St. Mary's Lake, Glacier National Park, Montana to the south of our area. From this evidence it seems most likely that var. *paysoni* is the race represented.

A. eucosmus Robins. (*Atelophragma elegans* (Hook.) Rydb.) In thickets along Crooked Creek and bank of beaver pond, vicinity of Sofa Mountain.

A. flexuosus Dougl. (*Homalobus flexuosus* (Dougl.) Rydb.) Occasional on prairie near east park boundary.

A. miser Dougl. var. **serotinus** (A. Gray) Barneby (*A. decumbens* (Nutt.) A. Gray var. *serotinus* (A. Gray) M. E. Jones; *Homalobus serotinus* (A. Gray) Rydb.) Several plants found on prairie one mile east of Waterton Park village.

A. occidentalis (S. Wats.) M. E. Jones (*A. macounii* Rydb.; *Atelophragma macounii* Rydb.) Occasional in coniferous woods along the Belly River.

A. striatus Nutt. (*A. adsurgens* Hook., not Pall.) Occasional on dry exposed hillsides in prairie near east park boundary.

A. tenellus Pursh (*Homalobus tenellus* (Pursh) Britton) Frequent on dry hillsides in prairie near east park boundary.

A. triphyllus Pursh (*Orophaca caespitosa* (Nutt.) Britton) On dry eroded hillsides in prairie, bank of the Waterton River.

A. vexilliflexus Sheld. (*A. pauciflorus* Hook., not Pall.; *Homalobus vexilliflexus* (Sheld.) Rydb.) Occasional on eroded prairie hillsides and alpine mountain summits.

Glycyrrhiza lepidota Nutt. Wooded bank of Lonesome Lake.

Hedysarum alpinum L. var. **americanum** Michx. (*H. americanum* (Michx.) Britton; *H. alpinum* subsp. *americanum* (Michx.) Fedtch) Occasional on river banks and grassland in vicinity of Sofa Mountain.

H. boreale Nutt. Frequent on river bars and prairie near east park boundary.

H. boreale var. **cinerascens** (Rydb.) Rollins (*H. cinerascens* Rydb.) Prairie near mouth of Cameron Creek at Waterton Park village.

H. sulphurescens Rydb. (*H. flavescens* Coult. & Fisher, not Regel & Schmalh.) Frequent on open wooded slopes from lower elevations to timberline.

Lathyrus ochroleucus Hook. Occasional in aspen woods at lower elevations.

Lupinus argenteus Pursh var. **macounii** (Rydb.) Davis (*L. macounii* Rydb.) Occasional on prairie and river bars at low and middle elevations.

L. lepidus Dougl. (*L. minimus* Dougl.; *L. ovinus* Greene). Vimy Ridge (Sheep Mountain), July 31, 1895, *Macoun 10413* (CAN).

L. sericeus Pursh Frequent on prairie and grassy slopes from low to middle elevations. Hairs of the stem spreading. This species is sometimes confused with *L. leucopsis* which does not occur east of the Rockies.

L. sericeus var. **flexuosus** (Lindl.) C. P. Smith (*L. flexuosus* Lindl.) Common on prairie at low and middle elevations. Hairs of stem appressed.

Medicago lupulina L. Introduced roadside weed at low elevation.

M. sativa L. Introduced along roadsides; Waterton River valley.

Melilotus alba Desr. Introduced along roadsides near east park boundary.

M. officinalis (L.) Lam. Frequent introduction along roadsides in Waterton River valley.

Oxytropis campestris (L.) DC. var **cusickii** (Greene) Barneby (*O. alpicola* (Rydb.) M. E. Jones; *Aragallus alpicola* Rydb.) Common on alpine summits.

O. campestris var. **gracilis** (A. Nels.) Barneby (*O. gracilis* (A. Nels) K. Schum.) Common on moist prairie at lower elevations.

O. deflexa (Pall.) DC. var **sericea** Torr & Gray (*O. retrorsa* Fern.) Occasional on moist prairie at low elevation near east park boundary. The acaulescent var. *foliosa* (Hook.) Barneby, possibly occurs in the area at high elevations.

O. sericea Nutt. var. **spicata** (Hook.) Barneby (*O. macounii* (Greene) Rydb.; *A. spicatus* (Hook.) Rydb.) Frequent on prairie and grassy slopes at low and middle elevations.

O. splendens Dougl. (*A. splendens* Greene, *A. richardsonii* Greene) Frequent on dry prairie at low elevations.

Petalostemon purpureus (Vent.) Rydb. Dry, south-facing slope on prairie near north park entrance.

Trifolium hybridum L. Introduced weed along roadsides in Waterton River valley.

T. pratense L. Introduced along streets in Waterton; occasional.

T. repens L. Introduced along highway near Lookout Butte.

Vicia americana Muhl. Occasional in rich woods at low elevations.

V. americana var. **angustifolia** Nees (*V. sparsifolia* Nutt.; *V. linearis* (Nutt.) Greene) Prairie near east park boundary.

GERANIACEAE

Geranium bicknellii Britton Occasional along roadsides at low elevations.

G. richardsonii Fisch & Troutv. (*G. albiflorum* Hook.) Common in rich woods at low and middle elevations.

G. viscosissimum Fisch. & Mey. (*G. canum* Rydb.) Common on moist prairie, thickets and hillsides at lower elevations.

LINACEAE

Linum perenne L. var. **lewisii** (Pursh) Eaton &Wright (*L. lewisii* Pursh; *L. perenne* subsp.*lewisii* (Pursh) Hultén; *L. sibiricum* DC. var. *lewisii* (Pursh) Lindl.; *L. pratense* (Norton) Small) Frequent on dry prairie and subalpine slopes.

CALLITRICHACEAE

Callitriche hermaphroditica L. (*C. autumnalis* L.) Submerged in quiet, shallow ponds at low and middle elevations.

C. palustris L. (*C. verna* L.) On mud at edge of beaver pond in vicinity of Sofa Mountain.

ANACARDIACEAE

Rhus radicans L. var. **rydbergii** (Small) Rehder (*Toxicodendron rydbergii* (Small) Green; *R. rydbergii* Small) Wooded east shore of Linnet Lake.

CELASTRACEAE

Pachystima myrsinites (Pursh) Raf. Occasional in coniferous woods at middle elevation.

ACERACEAE

Acer glabrum Torr. var. **douglasii** (Hook.) Dippel (*A. douglasii* Hook.; *A. glabrum* subsp. *douglasii* (Hook.) Wesml.) Common on streambanks at low and middle elevations in coniferous forest.

RHAMNACEAE

Ceanothus velutinus Dougl. In dry, Douglas fir (*Pseudotsuga menziesii*) woods on east slope of Mt. Crandell.

Rhamnus alnifolia L'Her. In damp thicket on north end of Waterton Lake at mouth of Cameron Creek.

MALVACEAE

Sphaeralcea rivularis Dougl. (*Phimosia rivularis* (Dougl.) Rydb.) Occasional on moist slopes at low and middle elevations. A handsome plant worthy of cultivation.

HYPERICACEAE

Hypericum formosum HBK. var. **scouleri** (Hook.) Coult. (*H. scouleri* Hook.) Frequent in subalpine meadows near timberline.

VIOLACEAE

Viola adunca J. E. Smith (*V. montanensis* Rydb.; *V. albertina* Greene, *V. subvestita* Greene) Occasional on dry prairie at low elevations, extending nearly to timberline on open slopes where it is nearly stemless.

V. glabella Nutt. Common along springs in spruce woods at middle and upper elevations.

V. nephrophylla Greene (*V. cognata* Greene) Occasional in bogs and margins of streams at low and middle elevations.

V. nuttallii Pursh var. **linguaefolia** (Nutt.) Jepson (*V. praemorsa* Dougl. subsp. *linguaefolia* (Nutt.) Baker & Clausen) Frequent on grassy slopes and shale slides at timberline; Carthew Pass, Crypt Lake and Avion Ridge.

V. orbiculata Geyer (*V. sarmentosa* Dougl. var. *orbiculata* (Geyer) A. Gray) Frequent in subalpine fir (*Abies lasiocarpa*) woods.

V. palustris L. Bog in coniferous woods at north end of Cameron Lake.

V. palustris var. **brevipes** (M. S. Baker) Davis (*V. palustris* subsp. *brevipes* M. S. Baker) Boggy subalpine shore of Summit Lake near timberline.

V. rugulosa Greene (*V. rydbergii* Greene) Common in aspen and pine woods at low and middle elevations. Plant spreading extensively by slender subterranean rootstocks.

ELAEAGNACEAE

Elaeagnus commutata Bernh. (*E. argentea* Pursh, not Moench) Frequent on stream banks at low elevations.

Shepherdia canadensis (L.) Nutt. (*Lepargyrea canadensis* (L.) Greene) Common in dry coniferous woods at low and middle elevations.

ONAGRACEAE

Circaea pacifica Aschers, & Magn. (*C. alpina* L. var. *pacifica* (Aschers. & Magn.) M. E. Jones) Wet woods along Bertha Creek at middle elevation.

Epilobium adenocaulon Hausskn. (*E. glandulosum* Lehm. var. *adenocaulon* (Hausskn.) Fern.) Frequent in wet woods along streams at low elevations.

E. alpinum L. (*E. anagallidifolium* Lam.) Occasional in wet subalpine meadows among *Larix lyallii* on Mt. Richards and along boggy shore of Goat Lake.

E. angustifolium L . (*Chamaenerion angustifolium* (L.) Scop; *C. spicatum* (Lam.) S. F. Gray) Frequent in open woods and grassy slopes at low elevations. Depauperate specimens, 6 to 10 inches high, were found at timberline on Mt. Crandell at an elevation of about 7,500 feet.

E. clavatum Trel. Common on exposed alpine and subalpine slopes.

E. glaberrimum Barbey var. **fastigiatum** (Nutt.) Trel. (*E. platyphyllum* Rydb.) Frequent on exposed subalpine slopes. Leaves glacous when fresh.

E. glandulosum Lehm. Damp shore of Waterton River near crossing.

E. hornemannii Reichenb. Frequent along wooded shores of brooks and lakes at middle and upper elevations.

E. lactiflorum L. Common along springs on forested slopes at middle and upper elevations.

E. latifolium L. (*Chamaenerion latifolium* (L.) Spach) Frequent on alpine slopes and gravelly bars of the Belly River.

E. palustre L. var. **lapponicum** Wahlenb. Bog in beaver pond area, vicinity of Sofa Mountain at middle elevation.

E. palustre var. **oliganthum** (Michx.) Fern. (*E. oliganthum* Michx.) In boggy beaver meadow, vicinity of Sofa Mountain.

E. paniculatum Nutt. Dry eroded bank of the Waterton River.

E. paniculatum forma **subulatum** Hausskn. Associated with the typical species.

Gaura coccinea Nutt. Occasional on dry prairie near east park boundary.

Gayophytum racemosum Torr. & Gray Disturbed soil at ground squirrel burrow on south slope of Mt. Glendowan, middle elevation. New to Canada.

Oenothera strigosa (Rydb.) Mack & Bush (*O. biennis* L. var. *canescens* Torr. & Gray) Occasional along roadsides; probably introduced into the park area.

HALORAGIDACEAE

Hippurus vulgaris L. Occasional in slow streams and shallow lakes at low elevations.

Myriophyllum verticillatum L. var. **pectinatum** Wallr. Quiet lakes at low elevations. Distributed at *M. spicatum* subsp. *exalbescens*.

ARALIACEAE

Oplopanax horridum (J. E. Smith) Miq. (*Echinopanax horridum* (J. E. Smith) Dcne. & Planch., not Cooper) In coniferous woods along old trail to Bertha Lake, elev. 5,000 feet, *E. H. Moss, 706* (UNA).

UMBELLIFERAE

Angelica arguta Nutt. (*A. lyallii* S. Wats.) Frequent in wet woods at middle elevations; less frequent at lower elevations. Flowers white; plant resembling *Heracleum lanatum.*

A. dawsoni S. Wats. Frequent in moist coniferous woods at middle elevations. Flowers yellow.

Bupleurum americanum Coult. & Rose Occasional on prairie near east park boundary and above timberline on Mt. Crandell.

Cicuta douglasii (DC.) Coult. & Rose (*C. occidentalis* Greene) Frequent in marshes along lakes and rivers at low elevations.

Lomatium dissectum (Nutt.) Math. & Const. var. **multifidum** (Nutt.) Math. & Const. (*Leptotaenia multifida* Nutt.) Frequent on grassy slopes at middle elevation.

L. sandbergii Coult & Rose (*Cogswellia sandbergii* (Coult. & Rose) M. E. Jones) Frequent on shale slides above timberline.

L. simplex (Nutt.) F. Macbr. var. **leptophyllum** (Hook.) Math. (*Cogswellia leptophylla* (Hook.) Rydb.) Occasional in submontane grassland near Lookout Butte and grassy slope at middle elevation on Mt. Glendowan.

L. triternatum (Pursh) Coult. & Rose (*Cogswellia triternata* (Pursh) M. E. Jones) Common in fescue grassland, vicinity of Sofa Mountain.

Heracleum lanatum Michx. (*H. maximum* Bartr., *nomen subnudum*) Common along streams in the forested belt extending to timberline.

Musenion divaricatum (Pursh) Nutt. var. **hookeri** Torr. & Gray (*M. trachyspermum* Nutt.) On dry exposed hills in prairie near east park boundary,

Osmorhiza chilensis Hook. & Arn. (*O. divaricata* Nutt.; *O. brevipes* (Coult. & Rose) Suksd.; *O. intermedia* (Rydb.) Blankinship) Common in coniferous woods at low and middle elevations.

O. depauperata Phil. (*O. obtusa* (Coult. & Rose) Fern.) Frequent in coniferous woods at middle elevations.

O. occidentalis (Nutt.) Torr. (*Glycosma occidentalis* Nutt.; *G. maxima* Rydb.) Common in aspen woods at low and middle elevations.

O. purpurea (Coult. & Rose) Suksd. (*O. leibergi* (Coult. & Rose) Blankinship) In wet spruce woods along trail between Cameron Lake and Summit Lake at middle elevations.

Perideridia gairdneri (Hook. & Arn.) Math. (*Carum gairdneri* (Hook. & Arn.) A. Gray; *Atenia gairdneri* Hook. & Arn.; *A. montana* (Blankinship) Rydb.) Frequent on moist prairie at low elevation near east park boundary.

Sanicula marilandica L. Occasional in moist woods; Belly River valley.

Sium suave Walt. (*S. cicutaefolium* Gmel.) Marshy shore of Maskinonge Lake.

Zizea aptera (A. Gray) Fern. (*Z. cordata* Koch, not *Smyrnium cordatum* Walt.) Frequent on low prairie near east park boundary.

CORNACEAE

Cornus canadensis L. (*Chamaepericlimenum canadense* (L.) Aschers. & Graebn.) Frequent in coniferous woods at low and middle elevations.

C. stolonifera Michx. (*Svida instolonea* A. Nels.; *S. interior* Rydb.; *C. alba* L. subsp. *stolonifera* (Michx.) Wang.) Frequent along the Belly River; probably not uncommon in other localities in the park area.

PYROLACEAE

Chimaphila umbellata (L.) Bartr. var. **occidentalis** (Rydb.) Blake (*C. occidentalis* Rydb.) Occasional in coniferous woods at low and middle elevations.

Monesis uniflora (L.) A. Gray (*Pyrola uniflora* L.) Moist spruce woods in vicinity of Sofa Mountain.

Pterospora andromedea Nutt. Dry pine woods along trail to Crypt Lake on east side of Waterton Lake.

Pyrola asarifolia Michx. var. **purpurea** (Bunge) Fern. (*P. uliginosa* Torr. & Gray) Frequent in moist coniferous woods.

P. bracteata Hook. (*P. asarifolia* var. *bracteata* (Hook.) Jepson; *P. rotundifolia* L. var. *bracteata* (Hook.) A. Gray) Occasional in coniferous woods at middle elevations.

P. minor L. (*Erxlebena minor* (L.) Rydb.) Springy place in coniferous woods at north end of Cameron Lake.

P. picta J. E. Smith Occasional in dry pine woods around Waterton Lake.

P. secunda L. (*Ramischia secunda* (L.) Garcke) Common in open coniferous woods at low and middle elevations.

P. virens Schweigger (*P. chlorantha* Swartz) Occasional in dry pine woods at low and middle elevations.

ERICACEAE

Arctostaphylos uvar-ursi (L.) Spreng. Occasional on dry slopes extending from lower elevations to timberline.

Gaultheria humifusa (Graham) Rydb. Occasional in subalpine meadows and open woods near timberline; Summit Lake and Mt. Lineham.

Kalmia polifolia Wang. var. **microphylla** (Hook.) Rehder (*K. glauca* Ait. var. *microphylla* Hook.; *K. microphylla* (Hook.) Heller; *K. occidentalis* Small) In bog around Summit Lake near timberline.

Ledum glandulosum Nutt. (*L. pacificum* Small) Occasional in moist coniferous woods at middle and upper elevations around Cameron Lake.

Menziesia glabella A. Gray Forming the predominant undergrowth in damp woods at middle and upper elevations around Cameron Lake.

Phyllodoce empetriformis (Smith) D. Don Frequent in damp alpine and subalpine meadows.

P. glandulifera (Hook.) Cov. Occasional in subalpine meadows. Mt. Rowe and Bertha Lake.

Vaccinium caespitosum Michx. Frequent in dry pine woods at low and middle elevations. Shrub up to 16 inches high from east slope of Mt. Crandell may be referred to var. **arbuscula** A. Gray.

V. membranaceum Dougl. (*V. globulare* Rydb., *V. oreophilum* Rydb.; *V. myrtillus* Hook., not L.) Frequent in coniferous woods at middle and upper elevations.

PRIMULACEAE

Androsace chamaejasme Host var. **lehmanniana** (Spreng.) Boivin (*A. lehmanniana* (Spreng.; *A. chamaejasme* subsp. *lehmanniana* (Spreng.) Hultén; *Drosace albertina* Rydb.) Alpine slope of Sofa Mountain.

A. septentrionalis L. var. **subumbellata** A. Nels. (*A. subumbellata* (A. Nels.) Small) Frequent on alpine summits of high mountains.

Dodecatheon conjugens Greene (*D. cylindrocarpum* Rydb.) In fescue grassland near Lookout Butte; probably not uncommon. Plant with mature capsules collected July 28. Stem and leaves glabrous.

D. conjugens var. **viscidum** (Piper) H. L. Mason (*D. viscidum* Piper; *D. conjugens* subsp. *viscidum* (Piper) Thompson) At timberline in cirque of Mt. Lineham. Flowers collected July 21 and immature capsules Aug. 13. Plant glandular-puberulent. Sometimes confused with *D. cusickii* which does not occur east of the Rockies.

D. pulchellum (Raf.) Merr. (*D. pauciflorum* (Durand) Greene; *D. salinum* A. Nels.) Frequent in bogs and moist prairie at low and middle elevations.

Douglasia montana A. Gray Several individual plants found on alpine summit of Mt. Crandell; associated with *Dryas octopetala* var. *hookeriana*. New to Canada.

Steironema ciliatum (L.) Raf. (*Lysimachia ciliata* L.) Frequent in moist thickets and woods along the Waterton River.

GENTIANACEAE

Gentiana affinis Griseb. (*Dasystephana affinis* (Griseb.) Rydb.) Sedge meadow near beaver pond in vicinity of Sofa Mountain.

G. amarella L. (*G. acuta* Michx.; *G. scopulorum*, *G. anisosepala* Greene; *G. strictiflora* (Rydb.) A. Nels.) Occasional in moist prairie near east park entrance and at timberline on Mt. Crandell.

G. barbata Fröl. (*G. macounii* Holm; *G. tonsa* (Lunell) Vict.; *G. raupii* A. E. Porsild) Bogs in beaver pond area, vicinity of Sofa Mountain.

G. calycosa Griseb. (*Anthopogon calycosa* (Griseb.) Rydb.) Frequent on moist slopes above timberline.

G. propinqua Richards. (*Amarella propinqua* (Richards.) Greene) Subalpine meadow on Mt. Richards and shore of Carthew Lakes.

G. fremontii Torr. (*Chondrophylla fremontii* (Torr.) A. Nels.) Alpine meadow at Carthew Lakes.

Menyanthes trifoliata L. In bog around beaver pond, vicinity of Sofa Mountain.

APOCYNACEAE

Apocynum androsaemifolium L. Shore of Linnet Lake at low elevation.

A. androsaemifolium var. **glabrum** Macoun (*A. scopulorum, A. ambigens* Greene) A low diffuse variant, occasional on dry exposed slopes.

A. canabinum L. Dry south-facing slope on prairie near north park entrance.

POLEMONIACEAE

Collomia linearis Nutt. Occasional on moist prairie along the Waterton River.

Linanthus septentrionalis H. L. Mason (*L. harknessii* (Curran) Greene var. *septentrionalis* (H. L. Mason) Jepson & Bailey) Disturbed soil at ground squirrel burrows on south-facing slope of Mt. Glendowan at middle elevation.

Phlox hoodii Richards. Occasional on dry hillsides in prairie near east park boundary.

Polemonium pulcherrimum Hook. (*P. parvifolium* Nutt.) Frequent on shale slides above timberline.

P. viscosum Nutt. (*P. confertum* A. Gray) Abundant on alpine slopes.

P. viscosum forma **leucanthemum** L. Wms. An evanescent albino form found on Avion Ridge associated with the typical blue-flowered phase.

HYDROPHYLLACEAE

Hydrophyllum capitatum Dougl. Occasional in wet meadows and slopes at middle and upper elevations.

Nemophila breviflora A. Gray Wet woods at edge of beaver pond in Blakiston Brook valley at low elevation.

Phacelia leucophylla Torr. Frequent on dry slopes at low and middle elevations.

P. lyallii (A. Gray) Rydb. Frequent on alpine and subalpine slopes.

P. sericea (Graham) A. Gray Common on shale slides above timberline.

Romanzoffia sitchensis Bong. Frequent in crevices of wet cliffs near waterfalls at upper elevations.

BORAGINACEAE

Cynoglossum officinale L. Introduced along roadside near Waterton River bridge.

Cryptantha sobolifera Payson (*Oreocarya glomerata* Standley, Contr. U.S. Nat. Herb. 22: 401, 1921, not *Cynoglossum glomeratum* Pursh) On gravel in Waterton River valley. New to Canada. Closely related to *C. bradburyana* and *C. sheldonii.*

Hackelia floribunda (Lehm.) Johnston (*Lappula floribunda* (Lehm.) Greene) Occasional in thickets along the Waterton River near bridge.

H. jessicae (McGreg.) Brand (*L. diffusa* of Alberta reports, not Lehm.) Common in open meadows and slopes, extending from lower elevations to timberline.

Lappula echinata Gilib. Introduced roadside weed; common.

Lithospermum ruderale Dougl. Frequent on prairie near east park boundary.

Myosotis alpestris Schmidt Common on alpine summits.

Plagiobothrys scopulorum (Greene) Johnston (*Allocarya scopulorum* Greene) In dried-up pond, beaver pond area, vicinity of Sofa Mountain.

VERBENACEAE

Verbena bracteata Lag. & Rodr. (*V. bracteosa* Michx.) Gravelly river bar, one mile east of Waterton.

LABIATAE

Dracocephalum parviflorum Nutt. (*Moldavica parviflora* (Nutt.) Britt.) Occasional in burnt-over woodland and along roadsides at low elevations.

Mentha arvensis L. var. **glabrata** (Benth.) Fern. (*M. glabrior* (Hook.) Rydb.) Frequent on wet shores of lakes and streams at low elevations.

Monarda fistulosa L. var. **menthaefolia** (Grah.) Fern. (*M. menthaefolia* Grah.) Common on prairie and around aspen bluffs at low elevations.

Prunella vulgaris L. var. **lanceolata** (Barton) Fern. (*P. vulgaris* subsp. *lanceolata* (Barton) Hultén) Occasional in open woods and banks at low elevations.

Stachys palustris L. var. **pilosa** (Nutt.) Fern. (*S. pilosa* Nutt.; *S. palustris* subsp. *pilosa* (Nutt.) Epling; *S. scopulorum* Greene) Occasional in moist meadows in Waterton River valley near east park boundary.

SCROPHULARIACEAE

Besseya cinerea (Raf.) Pennell (*B. wyomingensis* (A. Nels.) Rydb.; *Synthyris wyomingensis* (A. Nels.) Heller; *B. gymnocarpa* (A. Nels.) Rydb.) Common on alpine slopes and occasional on prairie at low elevations near east park boundary.

Castilleja cusickii Greenm. (*C. lutea* Heller) Occasional on prairie near east park boundary.

C. hispida Benth. Occasional in dry pine woods at low and middle elevations; Cameron Lake, Waterton Lake and Sofa Mountain.

C. lutescens (Greenm.) Rydb. Common on dry prairie near east park boundary.

C. miniata Dougl. (*C. tweedyi* Rydb.) Common in meadows and open woods at low and middle elevations.

C. occidentalis Torr. Occasional on alpine slopes; Mt. Rowe and Carthew Lakes.

C. rhexifolia Rydb. (*C. lauta* A. Nels.) Common on sparsely wooded subalpine slopes, extending above timberline.

Collinsia parviflora Dougl. Frequent in dry coniferous woods and on open slopes at low and middle elevations.

Linaria vulgaris Hill One plant found along main road at bridge over Blakiston Brook; introduced.

Mimulus guttatus Fischer (*M. langsdorfii* Donn) Along spring in poplar woods behind Waterton River ranger station.

M. tilingii Regel Wet cliffs by waterfalls near timberline; Bertha Lake and Goat Lake. Distributed as *M. caespitosus*.

M. lewisii Pursh Common along brooks in coniferous forest at middle and upper elevations.

Orthocarpus luteus Nutt. Occasional on dry prairie near east park boundary.

Pedicularis bracteosa Benth. (*P. montanensis* Rydb.) Openings in coniferous forest at middle elevation.

P. contorta Benth. At timberline on Sofa Mountain; rare.

P. groenlandica Retz. (*Elephantella groenlandica* (Retz.) Rydb.) Frequent in bogs at middle elevations.

Pentstemon albertinus Greene Frequent on exposed subalpine slopes.

P. confertus Dougl. Common on prairie at low elevation near east park boundary.

P. ellipticus Coult. & Fisher Common on alpine slopes. One of the most conspicuous dwarf rock plants found above timberline in the park area.

P. lyallii A. Gray (*P. linearifolius* Coult. & Fisher) Frequent on exposed slopes at middle elevations.

P. nitidus Dougl. Occasional on dry prairie hillsides and river banks near east park boundary.

Rhinanthus crista-gallii L. (*R. kyrollae*, *R. rigidus* Chab.) Occasional on moist prairie and open slopes; Lookout Butte and Mt. Glendowan.

Veronica alpina L. var. **unalaschcensis** Cham. & Schlecht. (*V. wormskjoldii* Roem. & Schult.) Common in moist subalpine meadows.

V. americana Schwein. Occasional along springs in woods at low elevations.

V. peregrina L. var. **xalapensis** (HBK.) St. John & Warren (subsp. *xalapensis* (HBK.) Pennell; *V. xalapensis* HBK.) Margin of dried-up pond near Lookout Butte.

V. salina Schur (*V. comosa* Richter; *V. catenata* Pennell; *V. connata* Pennell subsp. *glaberrima* Pennell) Shore of small lagoon near Waterton River.

V. scutellata L. Occasional along margins of lakes and streams at low elevations.

V. serpyllifolia L. var. **humifusa** (Dickson) Vahl (*V. tenella* Allioni; *V. serpyllifolia* var. *borealis* Laestad.) In thickets. *J. J. Sexsmith 30 & 67* (DAL).

OROBANCHACEAE

Orobanche fasciculata Nutt. (*Anoplanthus fasciculatus* (Nutt.) Walp.) Occasional on dry prairie near east park boundary.

O. uniflora L. (*A. uniflorus* (L.) Endl.) In coniferous forest on east side of Cameron Lake among *Tiarella unifoliata* under *Alnus crispa* var. *sinuata*.

LENTIBULARIACEAE

Pinguicula vulgaris L. var. **macroseras** (Link) Herder (*P. macroseras* Link) In bog at north end of Cameron Lake.

Utricularia minor L. Boggy edge of beaver pond in vicinity of Sofa Mountain; probably not rare.

U. vulgaris L. var. **americana** A. Gray (*U. macrorhiza* Le Conte; *U. vulgaris* subsp. *macrorhiza* (Le Conte) R. T. Clausen) Frequent in bogs and shallow lakes at low elevations.

PLANTAGINACEAE

Plantago major L. Introduced weed along roads and vacant lots in Waterton Park village.

RUBIACEAE

Galium boreale L. Common on prairie and open grassy slopes at low and middle elevations.

G. trifidum Michx. Moist willow thicket along the Belly River; scarce.

G. triflorum L. Boggy meadow in beaver pond area, vicinity of Sofa Mountain and marshy north shore of Maskinonge Lake.

CAPRIFOLIACEAE

Linnaea borealis L. var. **americana** (Forbes) Rehder (*L. americana* Forbes; *L. borealis* subsp. *americana* (Forbes) Hultén) Dry pine woods in Belly River valley; scarce.

Lonicera dioica L. var. **glaucescens** (Rydb.) Butters (*L. glaucescens* Rydb.) Occasional on river banks and open pine woods at low elevations.

L. involucrata (Richards.) Banks (*Distegia involucrata* (Richards.) Cockerell) In rich moist woods and swamps in Belly River valley; scarce.

L. utahensis S. Wats. (*Xylosteon utahense* (S. Wats.) Howell) Frequent in subalpine woods.

Sambucus racemosa L. var. **melanocarpa** (A. Gray) McMinn (*S. melanocarpa* A. Gray) Frequent in moist woods and open slopes at middle and upper elevations.

Symphoricarpos albus (L.) Blake (*S. racemosus* Michx.; *S. pauciflorus* (Robins.) Britton) Common in pine and aspen woods at low elevations.

S. occidentalis Hook. Common in moist depressions on prairie, borders of aspen groves and on river banks.

Viburnum edule (Michx.) Raf. (*V. pauciflorum* Pylaie; *V. eradiatum* (Oakes) House) Rich woods in Belly River valley; scarce.

VALERIANACEAE

Valeriana dioica L. var. **sylvatica** (Soland.) A. Gray (*V. sylvatica* Soland.; *V. septentrionalis* Rydb.; *V. dioica* subsp. *sylvatica* (Soland.) F. G. Meyer) Frequent in moist meadows and aspen woods, vicinity of Sofa Mountain.

V. sitchensis Bong. Common in subalpine meadows and along brooks at middle elevations.

CAMPANULACEAE

Campanula rotundifolia L. (*C. petiolata* A. DC.) Common on prairie and open slopes at low elevations. Depauperate alpine forms, 1 to 3 inches tall, occur at high elevations above timberline.

COMPOSITAE

Adenocaulon bicolor Hook. Occasional in coniferous woods at low and middle elevations.

Achillea millefolium L. var. **alpicola** (Rydb.) Garrett (*A. alpicola* Rydb.; *A. subalpina* Greene) Frequent on exposed alpine and subalpine slopes.

A. millefolium var. **lanulosa** (Nutt.) Piper (*A. lanulosa* Nutt.) Common on prairie near east park boundary at low elevation.

Agoseris aurantiaca (Hook.) Greene (*A. gracilens* (A. Gray) Kuntze; *A. graminifolia* Greene) Frequent in subalpine meadows near timberline and occasional in pine woods at middle elevations.

A. glauca (Pursh) Raf. Moist grassy meadow near north park entrance at low elevation.

A. glauca var. **agrestis** (Osterh.) Q. Jones (*A. agrestis* Osterh.; *A. altissima, A. turbinata* Rydb.) Common on prairie near east park boundary.

A. glauca var. **dasycephala** (Torr. & Gray) Jepson (*A. scorzoneraefolia* (Schrad.) Greene; *A. aspera, A. villosa* Rydb.; *A. eisenhoweri* Boivin) Frequent on shale slides above timberline and occasional on

Anaphalis margaritacea (L.) C. B. Clarke var. **subalpina** A. Gray (*A. subalpina* (A. Gray) Rydb.) Occasional in woods at low and middle elevations.

Antennaria alpina (L.) Gaertn. Occasional on alpine summits of high mountains.

A. alpina var. **media** (Greene) Jepson (*A. media, A. macounii, A. chlorantha, A. pulvinata* Greene; *A. reflexa* E. Nels.; *A. acuta* Rydb.) Common on alpine slopes.

A. alpina var. **monocephala** (DC.) Torr. & Gray (*A. monocephala* DC.) Alpine slope at Carthew Pass. Heads usually solitary.

A. anaphaloides Rydb. Occasional in upland prairie near east park boundary.

A. lanata (Hook.) Greene (*A. carpathica* (Wahl.) R. Br. var. *lanata* Hook.) Occasional in alpine and subalpine meadows; Goat Lake and Mt. Rowe.

A. luzuloides Torr. & Gray (*A. oblanceolata* Rydb.) Above timberline on south-facing slope of Mt. Carthew.

A. neglecta Greene var. **attenuata** (Fern.) Cronq. (*A. obovata* E. Nels.; *A. stenolepis* Greene) Occasional in dry pine woods at low and middle elevations.

A. neglecta var. **howellii** (Greene) Cronq. (*A. howellii* Greene) Frequent in dry, open pine woods at low elevations.

A. parvifolia Nutt. (*A. aprica* Greene) Occasional on dry prairie near east park boundary.

A. pulcherrima (Hook.) Greene (*A. carpathica* (Wahl.) R. Br. var. *pulcherrima* Hook.) Occasional in damp beaver meadows and springy places; vicinity of Sofa Mountain.

A. racemosa Hook. Frequent in open coniferous woods at middle and upper elevations.

A. rosea Greene (*A. concinna, A. foliacea, A. imbricata, A. oxyphylla, A. scariosa* Greene) Common on open prairie, dry woods and mountain slopes at middle and upper elevations.

A. rosea var. **nitida** (Greene) Breitung (*A. nitida* Greene; *A. microphylla* Rydb., not Gandoger; *A. arida* E. Nels.; *A. bracteosa* Rydb.) Occasional on prairie at low elevation.

A. umbrinella Rydb. (*A. aizoides, A. sedoides, A. sansonii* Greene; *A. albescens* (E. Nels.) Rydb.; *A. flavescens* Rydb.; *A. mucronata* E. Nels.) Common on grassy slopes extending from lower elevations to timberline.

Anthemis tinctoria L. Escaped at fish hatchery and near Waterton River crossing.

Arctium minus (Hill.) Bernh. Introduced weed in abandoned yard east of Knight's Lake in Waterton River valley.

Arnica alpina (L.) Olin var. **tomentosa** (J. M. Macoun) Cronq. (*A. tomentosa* J. M. Macoun; *A. alpina* subsp. *tomentosa* (J. M. Macoun) Maguire) Occasional on windswept alpine summits of high mountains.

A. amplexicaulis Nutt. (*A. macounii* Greene) Occasional along streams through coniferous woods at middle elevations; Cameron Lake and Bertha Lake.

A. chamissonis Less. var. **angustifolia** Herder (*A. foliosa* Nutt.; *A. chamissonis* ssp. *foliosa* (Nutt.) Maguire) Occasional in wet meadows, thickets and aspen woods at low altitude near east park boundary.

A. cordifolia Hook. Frequent in coniferous woods from middle elevations to timberline.

A. fulgens Pursh Open south-facing slope of Mt. Glendowan; probably common. Closely related to *A. sororia.*

A. latifolia Bong. (*A. granulifera* Rydb.) Abundant in moist woods and meadows at middle elevations.

A. latifolia var. **gracilis** (Rydb.) Cronq. (*A. gracilis* Rydb.; *A. columbiana* A. Nels.; *A. puberula* Rydb.) Frequent on open slopes at high elevations.

A. longifolia D. C. Eaton Occasional along brooks and among boulders at timberline; Crypt Lake, Goat Lake and Bertha Lake.

A. louisiana Farr Rock slide above timberline near summit of Mt. Richards. Not known previously from south of Banff National Park.

A. mollis Hook. Occasional in subalpine meadows and along brooks at timberline.

A. parryi A. Gray Occasional in borders of woods in the foothills near east park boundary.

A. rydbergii Greene Common on exposed alpine and subalpine slopes.

A. sororia Greene Frequent on low prairie in Waterton River valley near east park boundary. Additional collecting is necessary to determine the relative abundance of *A. sororia* and *A. fulgens,* if specifically distinct.

Artemisia biennis Willd. Along roadside in Waterton River valley; probably introduced into the park area.

A. campestris L. var. **scouleriana** (Bess.) Cronq. (*A. scouleriana* (Bess.) Rydb.; *A. desertorum* var. *douglasiana* Bess.; *A. pacifica* Nutt.; *A. camporum Rydb.)* Occasional on prairie and gravelly river bars.

A. dracunculus L. (*A. glauca* Pall.; *A. dracunculoides* Pursh) Frequent on dry prairie and exposed river banks near east park boundary.

A. frigida Willd. Frequent on dry, exposed river banks and prairie.

A. ludoviciana Nutt. (*A. gnaphalodes* Nutt.; *A. rhizomata* A. Nels.) Frequent on dry prairie near east park boundary.

A. ludoviciana var. **incompta** (Nutt.) Cronq. (*A. incompta* Nutt.; *A. ludoviciana* subsp. *candicans* (Rydb.) Keck.) Edge of pine woods at north end of Waterton Lake.

A. michauxiana Bess. (*A. discolor* Dougl.) Frequent on open slopes and thin woods upper elevations.

Aster ciliolatus Lindl. (*A. lindleyanus* Torr. & Gray) Frequent in woods at lower elevations near east park boundary.

A. conspicuus Lindl. Common in thin woods at low and middle elevations.

A. eatoni (A. Gray) Howell (*A. mearnsii* Rydb.; *A. oregonus* of Cronq., not *Tripolium oregonum* Nutt.) Frequent along streams near east park boundary.

A. engelmanni (D. C. Eaton) A. Gray (*Eucephalus engelmanni* (D. C. Eaton) Greene) Frequent on open slopes and thin woods at middle elevations.

A. falcatus Lindl. var. **crassulus** (Rydb.) Cronq. (*A. crassulus* Rydb.) Prairie near east park entrance. Rhizomes creeping; pubescens of stem spreading; involucres 5 to 8 mm. high.

A. foliaceus Lindl. var. **parryi** (D. C. Eaton) A. Gray (*A. frondeus* (A. Gray) Rydb.; *A. diabolicus* Piper) Frequent in moist meadows from lower elevations to timberline.

A. hesperius A. Gray var. **laetevirens** (Greene) Cronq. (*A. osterhoutii, A. ciliomarginatus, A. tweedyi* Rydb.) Frequent in willow thickets, marshy meadows and shores at low elevations.

A. junciformis Rydb. (*A. junceus* of auth., not Ait.; *A. franklinianus Rydb.)* In bogs around beaver ponds, vicinity of Sofa Mountain.

A. laevis L. var. **geyeri** A. Gray (*A. geyeri* (A. Gray) Howell) Common on prairie at low elevation near east park boundary.

A. modestus Lindl. (*A. major* (Hook.) Porter; *A. sayanus* Nutt.) Occasional along woodland streams at low elevations.

A. pansus (Blake) Cronq. (*A. multiflorus* Ait. var. *pansus* Blake) Occasional on dry prairie hillside and moist meadow at low elevation near east park boundary. Stems clustered from a caudex or short rhizome; involucres small, 4 to 6 mm. high.

A. sibiricus L. var. **meritus** (A. Nels.) Raup (*A. meritus* A. Nels.; *A. richardsonii* Spreng.) Frequent on alpine summits, rocky slopes and gravelly river bars.

Balsamorrhiza sagitatta (Pursh) Nutt. Frequent on dry hillsides at low and middle elevations.

Bidens cernua L. (*B. glaucescens* Greene) Boggy shore of beaver pond in vicinity of Sofa Mountain.

Brickellia grandiflora (Hook.) Ell. (*Coleosanthes grandiflorus* (Hook.) Kuntze) On dry rocky slopes at low and middle elevations; foot of Mt. Crandell and along trail to Rowe Lakes.

Chrysanthemum leucanthemum L. (*C. leucanthemum* var. *pinnatifidum* Lecoq & Lamotte; *Leucanthemum vulgare* Lam.) Roadside near Waterton River crossing; introduced.

Chrysopsis villosa (Pursh) Nutt. var. **hispida** (Hook.) A. Gray (*C. hispida* (Hook.) DC.; *C. pumila, C. columbiana* Greene) Frequent on prairie near east park boundary.

Cirsium arvense (L.) Scop. Introduced weed along roadsides.

C. flodmanii (Rydb.) Arthur (*C. oblanceolatum* (Rydb.) K. Schum.) Occasional on low prairie near east park boundary.

C. hookerianum Nutt. (*C. kelseyi* (Rydb.) Petr.) Frequent on open grassy slopes at low and middle elevations, occasional at timberline.

C. **undulatum** (Nutt.) Spreng. (*C. engelmannii* Rydb.) Frequent on prairie near east park boundary.

C. **vulgare** (Savi) Airy-Shaw (*C. oblanceolatum* Scop., not Hill) Introduced weed along roadsides and in waste places.

Crepis atrabarba Heller (*C. occidentalis* Nutt. var. *gracilis* D. C. Eat.; *C. intermedia* var. *gracilis* (D. C. Eat.) A. Gray; *C. exilis* Osterh.) Grassy south-facing slope of Mt. Glendowan.

C. **elegans** Hook. (*Youngia elegans* (Hook.) Rydb.) Occasional on eroded river banks at low elevations.

C. **intermedia** A. Gray (*C. acuminata* Nutt. var. *intermedia* (A. Gray) Jepson) Occasional on dry, south-facing slopes in grassland, Waterton River valley.

C. **nana** Richards. (*Youngia nana* (Richards.) Rydb.) Occasional on shale slides above timberline.

C. **runcinata** (James) Torr. & Gray var. **hispidulosa** Howell (*C. runcinata* subsp. *hispidulosa* (Howell) Babcock & Stebbins; *C. platyphylla* Greene) Frequent in damp meadows and moist prairie at low and middle elevations.

Erigeron acris L. var. **asteroides** (Andrz.) DC. (*E. droebachensis* Muell.; *E. yellowstonensis* A. Nels.) In coniferous woods along trail to Goat Lake; scarce.

E. **acris** var. **debilis** A. Gray (*E. jucundus* Greene) Frequent on alpine slopes.

E. **asper** Nutt. var. **pubescens** (Hook.) Breitung forma **roseata** (Lunell) Breitung (*E. drummondii* Greene) Frequent on dry prairie and exposed hills near east park boundary.

E. **caespitosus** Nutt. Frequent on dry prairie near east park boundary.

E. **callianthemus** Greene (*E. salsuginosus* of authors, not *Aster salsuginosus* Richards.; *E. peregrinus* (Pursh) Greene subsp. *callianthemus* (Greene) Cronq.) Common in moist open woods and meadows at middle and upper elevations.

E. **callianthemnus** var. SCAPOSUS (Torr. & Gray) Breitung, comb. nov. (*E. salsuginosus* var. *scaposus* Torr. & Gray, Fl. N. Amer. 2: 503, 1843; *E. glacialis* (Nutt.) A. Nels.; *E. peregrinus* subsp. *callianthemus* var. *scaposus* (Torr. & Gray) Cronq.) Occasional on exposed alpine slopes.

E. **compositus** Pursh var. **glabratus** Macoun (*E. multifidus* Rydb.; *E. compositus* var. *multifidus* (Rydb.) Macbr. & Pays.) Most frequent on alpine summits of high mountains but also on gravelly river bars and prairie at low elevations.

E. **flagellaris** A. Gray Shore of Lonesome Lake. Not observed elsewhere in the park area.

E. **glabellus** Nutt. Occasional in moist meadows and open woods at low elevations.

E. **humilis** Graham (*E. unalaschkensis* (DC.) Vierh.) Occasional on moist alpine slopes at high elevations.

E. **lanatus** Hook. Exposed alpine summits at high elevations; Mt. Carthew and Avion Ridge.

E. **lonchophyllus** Hook. (*E. minor* Rydb.) Beaver meadows in vicinity of Sofa Mountain.

E. **ochroleucus** Nutt. var. **scribneri** (Canby) Cronq. (*E. macounii* Greene; *E. parryi* Canby & Rose) Alpine summit of Sofa Mountain.

E. **philadelphicus** L. (*E. purpureus* Ait.) Moist prairie by pond near east park boundary.

E. **speciosus** (Lindl.) DC. var. **macranthus** (Nutt.) Cronq. (*E. macranthus* Nutt.) Frequent on prairie near east park boundary.

E. **speciosus** var. CONSPICUUS (Rydb.) Breitung, trans. nov. (*E. conspicuus* Rydb. Mem. N.Y. Bot. Gard. **1**: 400, 1900; *E. subtrinervis* Rydb. var. *conspicuus* (Rydb.) Cronq.) Associated with var. *macranthus* and probably equally common.

E. **strigosus** Muhl. Grassy slope around pond near east park boundary.

Gaillardia aristata Pursh Frequent on prairie near east park boundary.

Gnaphalium microcephalum Nutt. var. **thermale** (E. Nels.) Cronq. (*G. thermale* E. Nels.) Prairie roadside along Blakiston Brook towards Red Rock Canyon.

Grindelia squarrosa (Pursh) Dunal var. **quasiperennis** Lunell (*G. perennis* A. Nels.) Occasional along roadsides and on river bars; probably introduced into the park area.

Helianthus laetiflorus Pers. var. **subrhomboideus** (Rydb.) Fern. (*H. subrhomboideus* Rydb.) Occasional on dry prairie near east park boundary.

H. nuttallii Torr. & Gray (*H. fascicularis* Greene) Along Crooked Creek near east park boundary.

Hieracium albiflorum Hook. Frequent in dry pine woods.

H. cynoglossoides Arvet-Touvet (*H. griseum* Rydb.) Occasional on dry banks and grassy slopes at low and middle elevations.

H. gracile Hook. Frequent in subalpine woods near timberline.

H. umbellatum L. var. **canadense** (Michx.) Breitung (*H. columbianum* Rydb.) Frequent in open woods and thickets at low and middle elevations.

Iva xanthifolia Nutt. (*Cyclachaena xanthifolia* (Nutt.) Fresen.) Roadside weed near east park boundary.

Lactuca biennis (Moench) Fern. (*L. spicata* (Lam.) Hitchc.; *L. multifida* Rydb.) Occasional in damp poplar woods, Waterton River valley.

L. tatarica (L.) C. E. Mey. var. PULCHELLA (Pursh) Breitung, comb. nov. (*Sonchus pulchellus* Pursh, Fl. Amer. Sept. 502, 1814; *Lactuca pulchella* (Pursh) DC.; *L. tatarica* subsp. *pulchella* (Pursh) Stebbins) Occasional on dry river banks at low elevations.

Liatris punctata Hook. (*Laciniaria punctata* (Hook.) Kuntze) Frequent on dry exposed prairie hillsides near east park boundary.

Madia glomerata Hook. Roadside weed in Waterton River valley.

Matricaria matricarioides (Less.) Porter (*Chamomilla suaveolens* Rydb.) Occasional along roadsides at low elevations; adventive into the area.

Microseris nutans (Geyer) Schultz-Bip (*Ptilocalais nutans* (Geyer) Greene) Open grassy, south-facing slope of Mt. Glendowan at middle elevations.

Petasites frigidus (L.) Fries var. **nivalis** (Greene) Cronq. (*P. vitifolius* Greene) Occasional along springs in forest, vicinity of Sofa Mountain.

P. sagittatus (Pursh) A. Gray Swampy woods at low and middle elevations; vicinity of Sofa Mountain and north end of Cameron Lake.

Prenanthes sagittata (A. Gray) A. Nels. (*Nabalus sagittatus* (A. Gray) Rydb.) Occasional in coniferous woods; Belly River valley and Bertha Creek.

Senecio canus Hook. (*S. purshianus* Nutt.) Frequent on dry prairie and grassy slopes extending to alpine mountain summits.

S. cymbalarioides Nutt. Exposed subalpine east slope of Sofa Mountain at fire lookout tower.

S. fremontii Torr. & Gray Frequent on shale slides above timberline.

S. hydrophiloides Rydb. Common in meadows and edge of moist woods at low elevations; found once near timberline in cirque of Mt. Rowe.

S. hyperborealis Greenm. Alpine slope at Carthew Pass. Perhaps not distinct from *S. resedifolius.*

S. integerrimus Nutt. var. **exaltatus** (Nutt.) Cronq. (*S. exaltatus* Nutt.; *S. lugens* Richards. var. *exaltatus* (Nutt.) A. Gray; *S. hookeri* Torr. & Gray; *S. dispar, S. perplexus* A. Nels.; *S. condensatus, S. columbianus* Greene) On moist slope in cirque west of Bertha Lake.

S. megacephalus Nutt. Common on open slopes and shale slides at middle and upper elevations; occasionally above timberline.

S. pauperculus Michx. var. **thomsoniensis** (Greenm.) Boivin (*S. flavovirens, S. tweedyi* Rydb.; *S. multnomensis* Greenm.; *S. flavulus* Greene) Common in meadows, on prairie and streambanks at low and middle elevations.

S. resedifolius Less. (*S. ovinus* Greene; *S. conterminus* Greenm.) Occasional on exposed shale slides at high elevations in the alpine zone.

S. subnudus DC. (*S. pauciflorus* Pursh var. *subnudus* (DC.) Jepson) Frequent in wet alpine and subalpine meadows.

S. triangularis Hook. (*S. saliens, S. variifolius* Rydb.) Common along streams in coniferous forest at middle and upper elevations.

Solidago canadensis L. var. **salebrosa** (Piper) M. E. Jones (*S. lepida* DC.; *S. elongata* Nutt.) Frequent in moist meadows of river valleys.

S. gigantea Ait. var. **serotina** (Kuntze) Cronq.

S. serotina Kuntze) Frequent on stream banks at low elevations.

S. graminifolia (L) Salisb. var. **major** (Michx.) Fern. Alluvial shore of Crooked Creek near east park boundary.

S. missouriensis Nutt. Common on dry prairie near east park boundary at low elevation.

S. missouriensis var. **extraria** A. Gray (*S. concinna* A. Nels.) Occasional in the foothills near east park boundary.

S. multiradiata Ait. (*S. ciliosa* Greene) Frequent on exposed alpine slopes.

S. multiradiata var. **scopulorum** A. Gray (*S. scopulorum* (A. Gray) A. Nels. Occasional in open coniferous woods at middle elevations. Perhaps only an ecological phase of typical *S. multiradiata.*

S. spathulata DC. var. **neomexicana** (A. Gray) Cronq. (*S. glutinosa* Nutt.; *S. decumbens* Greene var. *oreophila* (Rydb.) Fern.; *S. oreophila* Rydb.) Frequent in open pine woods and prairie near east park boundary at low and middle elevations.

S. spathulata var. **nana** (A. Gray) Cronq. (*S. glutinosa* var. *nana* (A. Gray) Cronq.; *S. decumbens* Greene) Exposed alpine summits on Mt. Crandell and Sofa Mountain.

Taraxacum ceratophorum (Ledeb.) DC. (*T. lapponicum* Kihlm.; *T. lacerum* Greene; *Leontodon ceratophorum* Ledeb.; *L. dumetorum* (Greene) Rydb.; *L. monticola* Rydb.) Frequent on alpine slopes and exposed summits.

T. eriophorum Rydb. (*T. ammophilum* A. Nels.; *T. angustifolium* Greene; *L. eriophorum* (Rydb.) Rydb.) Occasional on shale slides and alpine summits; Crypt Lake and Avion Ridge.

T. lyratum (Ledeb.) DC. (*T. rupestre* Greene; *T. scopulorum* Rydb.; *L. lyratum* Ledeb.) Common on exposed alpine summits.

T. officinale Weber (*L. taraxatum* L.) Introduced weed along roadsides and established in the native sod.

Townsendia parryi D. C. Eaton Gravel bar of the Waterton River and open slope near Rowe Lakes.

T. sericea Hook. (*T. excapa* (Richards.) Porter) Dry exposed windswept prairie hilltop near north park entrance.

Tragopogon dubius Scop. (*T. major* Jacq.) Occasional on prairie along the Waterton River; introduced.

NEW TAXA AND NEW COMBINATIONS PUBLISHED IN THIS LIST

Glyceria maxima Hartm. & Holmb. var. *grandis* (S. Wats.) Breitung.

Carex stenophylla Wahl. var. *eleocharis* (Bailey) Breitung.

Tofieldia glutinosa (Michx.) Pers. var. *montana* (C. L. Hitchc.) Breitung.

Veratrum viride Ait. var. *eschscholtzii* (A. Gray) Breitung.

Alnus crispa (Ait.) Pursh var. *sinuata* (Regel) Breitung.

Actaea rubra (Ait.) Willd. var. *arguta* (Nutt.) Breitung.

Descurainia richardsonii (Sweet) O. E. Schulz var. *procera* (Greene) Breitung.

Saxifraga adscendens L. var. *oregonensis* (Raf.) Breitung.

Dryas octopetala L. var. *hookeriana* (Juz.) Breitung.

Potentilla glandulosa Lindl. var. *pseudorupestris* (Rydb.) Breitung.

Potentilla gracilis Dougl. var. *nuttallii* (Lehm.) Breitung.

Erigeron callianthemus Greene var. *scaposus* (Torr. & Gray) Breitung.

Erigeron speciosus (Lindl.) DC. var. *conspicuus* (Rydb.) Breitung.

Lactuca tatarica (L.) C. E. Mey. var. *pulchella* (Pursh) Breitung.

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NOTES ON THE BIOLOGY OF THE RED-NECKED GREBE IN WESTERN ONTARIO

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The northeastward front of the main breeding range of the Red-necked Grebe *Colymbus grisegena holböllii* in Canada extends from the mouth of the Mackenzie River to Favourable Lake in northwestern Ontario and thence to Sioux Lookout and Whitefish Lake, the latter near Port Arthur (Snyder, Can. Field Nat. 68: 41-42, 1954). I lived in Sioux Lookout from 1951 until 1955, during which time I observed many Red-necked Grebes, mostly in the Sioux Lookout Forest District but also in the Port Arthur and Kenora Forest Districts. Observations suggest that parts of western Ontario such as the area around Perrault Falls support a high breeding population of this species, a condition not previously reported. In 1955, as I was not present in the district constantly, I saw very few grebes and so have not included 1955 observations in the following text.

Arrival Dates. — The Red-necked Grebe arrived in western Ontario a few days before the completion of the spring breakup in 1951, 1952, and 1953. In 1954, it arrived 3½ weeks before the breakup because of a protracted breakup associated with exceptionally cold weather in May. Arrival dates and locations are given in Table 1.

TABLE 1. Dates and locations of arrival of Red-necked Grebe

YEAR	ARRIVAL DATE	LOCATION
1951	May 5	Shoal Lake Narrows, Lake of the Woods
1952	May 6	Abram Lake, Sioux Lookout
1953	May 3	Kathlyn Lake, 25 miles south of Sioux Lookout
1954	April 29	Pelican Lake, Sioux Lookout

Departure Date. — Red-necked Grebes are commonly seen in western Ontario until late August. I am not certain that this indicates the time of departure, as I had little opportunity to visit grebe habitat later in the fall. The species becomes much less conspicuous during August owing to change of plumage and cessation of calling.

Courtship. — Courtship display by Red-necked Grebes can usually be observed upon their arrival in northwestern Ontario. I do not know when courtship ceases, but calling activity which is strongly associated with courtship persists until August.

Numbers. — The largest flock of Red-necked Grebes I saw in western Ontario was of about 80 birds, at Frog Rapids in Pelican Lake, Sioux Lookout, April 29, 1954. During the spring and early summer, while the birds are still conspicuous, it is not unusual to see several dozen during a day's travel. D. Van Vliet and I saw 60 adults on Wabaskang and Keynote lakes, near Perrault Falls, on June 17, 1953, and 42 on Wabaskang Lake on the following day.

Nest Observations. — Observations of nests are recorded in Table 2.

Egg counts were made for 25 of the 33 nests listed above. They contained from 1 to 7 eggs each, and the mean clutch size was 2.8 eggs. Nesting may commence as early as May 15 (12 days after arrival), but May 21 is the earliest I have seen eggs. Incubation lasts until June 23 or later. Considerable variation in clutch size is shown. Small clutches are possibly incomplete; large ones could be the result of 'dumping'.

Brood Observations. — Only 5 broods, of 1 to 3 young each, have been recorded. The record is given in Table 3.

Nesting Density. — The 7 Red-necked Grebes' nests seen on the eastern arm of Wabaskang Lake, June 17, 1953, were situated along 50 yards of shoreline. A comparable concentration of nests was noted at Indian Narrows the next day. Seventeen nests were seen on Wabaskang Lake in 1953, possibly representing one third or one quarter of the nests present on the lake. This suggests a breeding density of about a pair per map square mile.

Habitat. — Red-necked Grebe nests are usually found along the outer edges of marshes of emergent vegetation, particularly bulrushes *Scirpus* spp., cat-tails *Typha* sp. and horsetail

TABLE 2. Observation of nests of Red-necked Grebe

YEAR	DATE	PLACE	OBSERVATION	OBSERVERS
1951	June 20	Whitefish Lake	Nest with 4 eggs	A.T. Cringan, R.D. Muir, R. Robinson
1953	May 15 (approx.)	Misfit Lake*	Occupied Nest	C.L. Perrie
"	May 21	Abram Lake*	Occupied nest; 2 eggs on May 24	A.T.C., J.A. Macfie
"	June 2	Botsford Lake*	Nest with 4 eggs	J.A.M.
"	June 10	Abram Lake*	Two occupied nests	A.T.C., D. Van Vliet
"	June 12	Little Vermilion Lake*	Two nests with 2 eggs each; two empty nests	D.V., T. Batchelor
"	June 17	Wabaskang Lake, eastern arm†	Seven nests, with 1, 2, 3, 4, 2, 1 and 2 eggs	A.T.C., D.V.
"	June 17	Wabaskang Lake, central portion†	Three nests, with 4, 1 and 2 eggs	A.T.C., D.V.
"	June 17	Keynote Lake†	Two nests with 4 and 6 eggs	A.T.C., D.V.
"	June 18	Indian Narrows, Wabaskang Lake†	5 nests with 4, 7, 2, 1 and 1 eggs; one other occupied nest	A.T.C., D.V.
"	June 18	Small Lake near Wabaskang Lake†	Nest with 1 egg	A.T.C., D.V.
"	June 19	Wabaskang Lake†	Nest with 3 eggs	A.T.C., D.V.
"	June 19	Butterfly Lake*	Occupied nest	A.T.C., D.V.
"	June 23	Minnitaki Lake*	Occupied nest	A.T.C., D.V.
1954	June 6	Misfit Lake*	Nest with 2 eggs	A.T.C., J.H. Cringan

* near Sioux Lookout (50° 05' N., 91° 55' W.)
† near Perrault Falls (50° 20' N., 90° 08' W.)

Equisetum sp., also cane grass *Phragmites* sp., in 1 to 2 feet of water.

Predation. — Crows were predating the Red-necked Grebe's nests seen on Little Vermilion Lake by D. Van Vliet and T. Batchelor, June 12, 1953. They carried away 2 eggs during the period of observation.

Relationship to Water Level Fluctuations. — Water levels were exceptionally high during June and July, 1954, and many bulrush marshes such as are customarily used by nesting grebes lacked emergent vegetation. I believe that this inhibited nesting and was largely responsible for the reduction in the number of nest observations in 1954.

TABLE 3. Observation of broods of Red-necked Grebe

YEAR	DATE	PLACE	OBSERVATION	OBSERVERS
1952	July 2	Abram Lake*	Adult with 3 half-grown young	A.T.C., J.H.C.
1954	July 12	Wabaskang Lake†	Brood of 1	W.J.D. Stephen, J. Elbrink, R. Shuttlewood
"	July 28	Wine Lake†	Brood of 2	W.J.D.S., J.E., R.S.
"	Aug. 3	Wine Lake†	Brood of 2	W.J.D.S., J.E., R.S.
"	July 31	Halvorsen Lake†	Brood of 2	W.J.D.S., J.E., R.S.

* near Sioux Lookout
† near Perrault Falls

NOTES ON WILDFOWL OF SLAVE RIVER DELTA AND VICINITY, NORTHWEST TERRITORIES

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Foreword

To the naturalist, Slave River Delta, Northwest Territories, is an outstanding attraction for the Great Slave Lake Region. Like all northwestern deltoid areas, it lures waterfowl in greater number and variety than may be found in surrounding territory and because of this the writer has studied the delta on several occasions. The first visit, in early July 1932, was an assignment for the Northwest Territories and Yukon Branch. This was followed by more detailed inquiries for the Canadian Wildlife Service in early July, 1945 and 1949, and the latter part of July, 1951.

Before these, comparatively few skilled observations had been made on waterfowl, although many travelers had passed through the delta en route to Great Slave Lake and higher latitudes. Of the more or less random district records that appear in earlier literature, surprisingly few are specifically identified with the delta itself.

The delta at the mouth of Slave River is comparatively small. Owing to this fact, the author did not adopt aircraft methods of observation, as we did in surveys of the Peace-Athabaska and Mackenzie Deltas, but relied upon boat and canoe for securing information as to the occurrence, composition and relative abundance of wildfowl.

Subsequent aircraft investigations by Smith and Sutton (1952-1954) are superior to anything previously accomplished along these lines. These data go back to 1948, but only those of recent years are considered to be adequate for the present paper. The transects in this connection cover the Slave River Parklands, including Slave River Delta. Smith's percentages, as available, are employed in the following account of the waterfowl resources.

The Delta results, to date, are far from complete and invite much more detailed study on the ground. This is especially true with respect to information on breeding, eggs, nests and young; finer details as to occurrence and distribution within the delta; and closer dates as to time of arrival and departure of migrants, including length of stop-over periods.

Physical Characteristics

The area under review lies at the mouth of Slave River, Great Slave Lake, in latitude 61° 15′ N. The approximate center of the lake shore section is eight miles north of Fort Resolution, but the southwestern limit of the delta at Nagle Bay is only about 1.5 miles from the latter point. From there to its northeastern extremity near Jean River the overall width at the lake is about 16 miles. The total area amounts to about 60 square miles.

As in all alluvial precincts of this sort, the land is low and flat with monotonous uniformity. Tracts of grassy meadow, bog, muskeg and marsh are typical and widespread. The whole is fabricated into a labyrinth of major water courses, relic channels and small, shallow streams of sluggish current, creating innumerable islands and bars. Much of the area consists of open grasslands, most of which occur near the outer limits of the delta. Naked siltflats and sandbars, intersected by sinuous channels, compose the lakeside fringe in a wide arc from Moose Deer Island to Jean River. These provide first-class loafing stations for flocks of ducks, geese, and swans during migration.

In the shallow waters of the delta great quantities of emergent and subaquatic vegetation find a congenial habitat. Bullrush and sedge is the common emergent growth; here and there it is reinforced by small stands of cattail. Horsetail is a plentiful item on the muddy borders of streams, ponds, and marshes. Aside from the grassy meadows, the lowlands are clothed with various willows and alders, balsam poplar and local stands of black spruce. In addition to some of these, higher terrain also supports aspen popular, white spruce, and Banksian pine.

The adjacent shores of Great Slave Lake commonly present sandy and gravelly beaches, interrupted in places by rock outcrops. Off-lying islands are characterized by similar beaches, often strewn with boulders and quantities of driftwood. As contrasted with Slave River and other entering streams, most of the lake waters are cold and deep. The whole district falls within the Canadian Life Zone.

THE WATERFOWL POPULATION

The present area represents the largest typical delta in the Mackenzie River drainage system lying between Peace-Athabaska Delta and the even larger one at the mouth of Mackenzie River. For this reason it is both attractive and convenient for the thousands of wildfowl that here break their long migrational journeys to feed and rest. Despite its allurements for this purpose, the indigenous breeding population is only very moderate in size.

It is true that numerous species resort to the delta during the nesting season. However, the overall aggregate per square mile is clearly much smaller than in either of the two deltas mentioned above; the determining cause is not readily apparent. The average number of summer ducks in the Slave River Parklands from 1948 to 1954 was about 5.8 per square mile. According to observations made in the delta proper, in 1949 and 1951, the duck aggregate there in midsummer averaged about double the latter figure, or around 10 to 12 individuals per square mile.

The waterbird total, of course, is vastly increased during spring and fall migrations. Not only is the number of ducks greatly multiplied, but thousands of Canada, Lesser Snow, and White-fronted Geese also resort to the outer fringes of the delta. Relatively few geese inhabit the wooded depths of the area along the streams, but spectacular concourses assemble on the mudflats and sandspits from Nagle Bay northeast to Stony Island and beyond.

Based on local reports, the spring migration, although heavy, is not as massive as that of the autumn. Evidently the main stream from the south derives largely from Peace-Athabaska Delta over a route somewhat east of Slave River. From all accounts relatively few flocks actually follow the river valley. During the autumn migration the birds funnel into the delta from a wide territory to the north, many, in all probability, from the Liverpool Bay — Banks Island region and others, perhaps, from as far east as the Ellice and Perry River areas. The latter action is indicated by the occasional appearance of Ross's Goose whose nesting grounds lie along the latter stream.

ANNOTATED LIST OF SPECIES

Common Loon *Gavia immer* (Brünnich) — The great northern diver was not observed within the actual confines of Slave River Delta, but was met with on several occasions in neighboring parts of Great Slave Lake. It is more frequently seen in sheltered bays and around islands than elsewhere in these waters. As it occurs throughout the summer, it may be expected to breed wherever found.

Yellow-billed Loon *Gavia adamsi* (Gray) — The writer never encountered this species in the present area during the summer months. It is improbable that it stays as far south as Great Slave Lake in the nesting season, but numbers occur during the spring and fall migrations. Preble (1908) remarks: "At Hay River, Great Slave Lake, it is frequently shot in May, when the ice begins to break up, but is less often seen at Fort Resolution." The south-bound migration evidently takes place in the latter part of October.

Pacific Loon *Gavia arctica pacifica* (Lawrence) — This is a common summer resident in parts of Great Slave Lake, particularly along the north and east shores, around the outlet at Big Island, and west into Mills Lake. According to personal observations it is very scare along the southwest shore from Fort Resolution to Pointe Desmarais. On July 7, 1932, one was observed near Green Island and another off Egg Island on July 25, 1951. It is not known to visit Slave Delta, but it undoubtedly occurs there, or in the immediate vicinity, when the ice goes out in the spring.

Red-throated Loon *Gavia stellata* (Pontoppidan) — Preble (1908) considered this species the commonest member of the genus from Great Slave Lake northward. While rare during the summer along the southwest quarter of the lake, apparently it is a plentiful breeder around rocky islands to the north of Fort Resolution and farther east. In the immediate area under review it was only once seen by the writer, on July 7, 1932, between Fort Resolution and Green Island.

Red-necked Grebe *Colymbus grisegena holböllii* (Reinhardt) — On July 3, 1949, a single example was seen in Slave Delta and a pair noted in the same area on July 26, 1951. Evidently the species is scarce locally, as several observers who passed through the locality failed to list it. Preble (1908) saw a pair on the lake near Fort Resolution on June 20, 1903. Presumably *grisegena* breeds in the area, but apparently there is no record of nests and eggs having been found.

Horned Grebe *Colymbus auritus* Linnaeus — This grebe breeds regularly, but sparingly, in the delta and suitable ponds and lakes in the general vicinity. It appears to be the commonest member of the genus in the district. Several were noted in the delta on July 5, 1945; July 3, 1949; and others in late July, 1951. It was seen by Preble (1908) at Fort Resolution on June 20, 1903. Mr. Cecil Law of the Canadian Wildlife Service informed me that he saw young of this species in the delta during July, 1949.

Eared Grebe *Colymbus caspicus californicus* (Heermann) — The Eared Grebe is one of the bird rarities at Great Slave Lake. Actually, it appears to be very near the northern limits of its breeding range even at Peace-Athabaska Delta, in consequence of which only odd strays occur farther north. Preble (1908) notes that Kennicott took a specimen at Fort Resolution in 1860, which at that time was apparently the only authentic record for the region. The only one that can be added to that by the writer is based on an observation by Mr. Cecil Law who stated that he saw adults and young in Slave Delta during July 1949.

Pied-billed Grebe *Podilymbus podiceps podiceps* (Linnaeus) — This is also a scarce species which was not personally observed. Evidently it is a little less rare than the Eared Grebe since Preble (1908) refers to several records for Great Slave Lake, including Fort Resolution. Fairbairn (1931) noted examples at Murky Lake (south of Snowdrift) and Pine Point, Great Slave Lake.

Whistling Swan *Olor columbianus* (Ord) — Numbers of these birds resort to the mudflats and sandbars on the outer fringe of the delta, and elsewhere along the lakeshore, on both spring and fall migrations. In the former season they appear ordinarily during the early part of May; some may linger for a fortnight, or more, before resuming their journey to the Arctic coast in late May or early June.

On the return flight the earliest arrivals reach the district about mid-September; a few remain until early October. Local residents state that the birds occur in only moderate numbers and are much less plentiful than during the early days of the fur trade.

Canada Goose *Branta canadensis* (Linnaeus) — It is by no means a very common summer resident, but odd pairs are scattered in sequestered areas more or less throughout the district. Local residents state that at one time it nested on islands west and southwest of Fort Resolution (including Egg Island), but of late years has withdrawn. Apparently it arrives in the spring earlier than any other geese, sometimes appearing during the last week of April. Small flocks of apparently nonbreeding individuals are sometimes seen in midsummer at, or in the vicinity of the delta and elsewhere. Downy young appear by late June or early July.

During the spring and fall migrations considerable numbers resort to the outer flats of the delta and shorelines northeast to Grant Point. Others occur at the mouth of Taltson River. At certain times during the migrational periods a marked percentage of the birds are a smaller race, which has been noted in the region by Preble (1908), Seton (1911), and others. They nest much farther north, including Arctic coastal tracts. Southward movement of the species into the Slave Delta country occurs during the latter part of September, while flocks are seen leaving irregularly from mid-September until early October.

White-fronted Goose *Anser albifrons* (Scopoli) — It is clear from local reports that these birds are much less numerous during migration than either Canada or Lesser Snow Geese. Usually they appear in the early part of May and tarry for a week or two to feed and rest. They are next seen during early September. Small groups keep arriving and departing for a fortnight, or more, while a few stragglers remain until the forepart of October. Some groups appear highly reluctant to leave until forced out by the freeze-up.

Lesser Snow Goose *Chen hyperborea hyperborea* (Pallas) — This species is an abundant spring and fall migrant. Based on information obtained at Fort Resolution, it is nearly, if not quite, as numerous as the Canada Goose, and at times in some favored localities it far exceeds that species in abundance. Favorite resorts are the mudflats and sandbars extending locally all the way from Nagle Bay to the small delta at the mouth of Taltson River. Another well-patronized stop-over locality extends from near the outlet of Great Slave Lake downstream to Mills Lake.

Evidently most of the flocks derive from Peace-Athabaska Delta as they gradually push northward with the advance of spring. According to season, the birds arrive from early to mid-May, rest and feed for a time, and then irregularly depart during the latter part of May. A few stragglers have been seen in early June.

Some individuals arrive from the north by early September, but the peak of the migration is not reached until about the third week of the month. As with all geese, the exodus is not characterized by a mass movement at a particular time, but flocks leave gradually over the days until the early part of October.

Blue Goose *Chen caerulescens* (Linnaeus) — There is apparently no definite record for Slave Delta, nor immediate vicinity, but a number of occurrences are known for the region as a whole. These are: Preble (1908), Fort Providence; Seton (1911), Chipewyan; and Soper (1942), for Chipewyan and Athabaska Delta. The birds are rare, appearing at long intervals in migrating flocks of Lesser Snow Geese. An occasional stray is certainly to be looked for at Slave River Delta.

Ross's Goose *Chen rossi* (Cassin) — In this district *rossi* has much the same status as the Blue Goose — that is, a rare straggler. It is locally known as the 'Scabby-nosed Wavey', or 'Galoot'. On apparently good authority, a few of these birds occasionally visit Slave Delta and localities to the east. This development is not surprising, as the species concentrates during migration in Peace-Athabaska Delta while traveling to and from its breeding grounds along Lower Perry River. A line projected directly between the two points for the main stream of migration is only about 160 miles east of Slave Delta. With seasonal variations and stop-overs, the times of migration in this territory are roughly through late May and early June and during the last two or three weeks of September.

Common Mallard *Anas platyrhynchos platyrhynchos* Linnaeus — As in many other localities, this species is the predominating duck in the breeding population of the delta, where its average numerical status is approximately 20.2 percent of all game ducks. Seasonal fluctuation occurs, however, when the scaups are locally more abundant. Mallards are among the earliest of birds to arrive in the spring; normally, the period is from late April to early May. Young begin to appear about the third week of June. Egg-laying and hatching may vary as much as 10 days, or more, depending on the weather from year to year. Some individuals remain in the region until early October, or even later if the freeze-up is delayed.

Pintail *Anas acuta* Linnaeus — During the summer these birds occur in about the same numbers as the Baldpate, with a several-year average of about 11.2 percent of the total duck population. In occasional seasons the birds are much more common than in others, while the reverse sometimes takes place when they appear to be very scarce. On one visit to the delta (July 1949) not a single one was observed. They are temporarily in greater abundance during the spring and autumn migrations. The period of summer residence is practically identical with that of the Mallard.

Green-winged Teal *Anas carolinensis* Gmelin — This species occurs with fair frequency in summer, but is not nearly so numerous as farther south. On a long-term average it occupies sixth place in the local list of ducks, with a ratio of about 10.9 percent, thus placing it in practically the same category as the Baldpate. Seasonal variation in numerical status is sometimes pronounced. It is possible, at times, to voyage through the delta in midsummer without observing a single individual. As with many other species, it is more abundant during spring and autumn. The total span of local residence embraces the period from about early May until early October.

Blue-winged Teal *Anas discors* Linnaeus — So scarce is this species in the district that relatively few observers have recorded it. The writer saw it only once when a male was flushed in Slave Delta on July 27, 1951. Here it is essentially at the very northern limit of its geographical range.

Macfarlane (1908) states that an adult female with a nest and three eggs were found at Fort Providence on June 1, 1885. Preble (1908) notes that Ross recorded it as being rarely found at Fort Resolution; Kennicott saw an example at the latter place on May 7, 1860, and collected one there a month later. Smith (1952-1954) does not list the species for the Slave River Parklands. In Athabaska Delta and southern Wood Buffalo Park the species occurs more frequently (Soper, 1942).

Baldpate *Mareca americana* (Gmelin) — A moderately common summer resident in the delta and neighboring country. Numbers were observed on all visits to the district, including juveniles on some occasions. On a several-year average it ranks fifth in place among the ducks with a specific ratio of 11.0 percent. Noticeable fluctuation occurs from year to year, but it holds fairly steady at about half the numerical status of the Mallard. Period of local residence extends from about early May until late September, although a few may remain until early October.

Shoveler Spatula clypeata (Linnaeus) — The shoveler breeds at Slave Delta, but it occurs there only as a very sparing summer resident and migrant. On several visits to the area, the writer detected only two or three examples, plus one brood of young on July 6, 1945. It is among the scarcest of the game ducks with an average ratio of only 2.3 percent. On some occasions observers have failed to see any. It is assumed that *clypeata* is somewhat commoner in the spring and fall as numbers pass through in May to nest in higher latitudes. For this district, Preble (1908) lists the species as breeding at Fort Resolution and Big Island.

Wood Duck *Aix sponsa* (Linnaeus) — One hesitates to list this species since its accidental occurrence in the region is so extremely rare and also because Slave Delta and vicinity is devoid of any records. However, there is one record by Macfarlane (1908) in the same latitude to the west: "On the 15th of May, 1885, Mr. Reid, of Fort Providence, found a nest of this duck in a hole in a dry spruce tree. It was composed of hay and feathers and contained two freshly deposited eggs." Preble (1908) refers to its rare occurrence on the Lower Peace and at Chipewyan. It should be pointed out that northern residents commonly refer to 'wood ducks', a term, however, that is usually reserved in that country for the Buffle-head.

Redhead *Aythya americana* (Eyton) — Few observers have detected this species north of the prairies. Preble (1908) does not list it for any point north of Edmonton. However, the writer saw several in southern Wood Buffalo Park and others nearly as far north as Pine Lake (Soper, 1942). The only record available for the Northwest Territories appears to be that of Macfarlane (1908): "It is a rare bird in the Northern Territories of Canada. Chief Trader B.B. Ross saw a few at Fort Resolution, Great Slave Lake, where he also secured a nest with its eggs."

Ring-necked Duck *Aythya collaris* (Donovan) — This is a rather scarce species in the district; it is seldom encountered. On July 4, 5 and 6, 1932, the writer saw a few on Lower Slave River between Brulé Point and Fort Resolution, and also west to Pine Point. On July 3, 1949, a pair was noted near Slave Delta at Nagle Bay. In the Northwest Territories few observers have met with the species — at least, to identify it as such (see Preble, 1908). It is locally more numerous in nearby Wood Buffalo Park (Soper, 1942).

Canvas-back *Aythya valisineria* (Wilson) — It is more than evident that this is a rare bird in the immediate area under review. There seem to be no recent records; the writer failed to find it and Smith (1952-1954) does not list it for the Slave River Parklands. However, Baird, Brewer and Ridgway state that the species was found breeding at Fort Resolution (Preble, 1908), ostensibly in Slave River Delta. Preble remarks that "this north-westerly ranging species occurs rather commonly in certain marshy districts in the Mackenzie Valley, but has rarely been detected to the eastward of that stream."

Greater Scaup Duck *Aythya marila* (Linnaeus) — This is a more northern ranging species than the Lesser Scaup, but according to the records it is seldom seen in the Great Slave Lake district. Few observers have listed it, probably because of the difficulty of separation from *affinis* during noncollecting procedures. There seems to be no definite record for the delta itself, but numbers occur in the adjoining lake.

The writer saw the birds but once, with certainty, when a pair was encountered near Egg Island on July 25, 1951. From July 11 to 14, 1901, Preble (1908) observed a few daily at Loon Island, 50 miles north of Fort Resolution. He also notes that Ross (1862) recorded the species "north to Fort Resolution." For reasons given above it may be more numerous, individually, and in association with flocks of Lesser Scaups, than the records would seem to indicate.

Lesser Scaup Duck *Aythya affinis* (Eyton) — This species is fairly common and well distributed, but it is clearly more at home in some areas than others. Numbers were seen personally on all visits to the delta; also along Lower Slave River and in several localities between Fort Resolution and Mills Lake. This is one of the later breeders in the north, apparently deferring the time of egg-laying until late June and early July.

Of recent years the local scaups (collectively) have occupied second place among the regular game ducks, with an average ratio of about 20.0 percent. In numerical status they seem, therefore, to be only slightly less common than the Mallard, but more plentiful than scoters. The records show, however, that marked reciprocal fluctuation in relative abundance is not an uncommon development. The average span of local residence covers the period from early May until about mid-October.

American Golden-eye *Bucephala clangula americana* (Bonaparte) — While this species is an abundant breeder along Lower Athabaska River and over most of Wood Buffalo Park, numbers diminish on Lower Slave River to Great Slave Lake. In Slave Delta and vicinity relatively few are met with. The same applies to the whole southwest shore of Great Slave Lake. The birds appear as soon as open water is available, which is normally some time in the early half of May. The first young hatch about the middle of June.

For some unknown reason the summer resident population appears to be considerably larger some years than others. For the district as a whole, aerial transect data indicate that the species has a mean summer ratio of only 3.5 percent of the total duck population. The birds are much more numerous in spring and fall. From late September until about mid-October large 'rafts' appear on the larger streams such as the Slave, Peace, and Athabaska Rivers. During an open season some flocks remain until early November.

Barrow's Golden-eye *Bucephala islandica* (Gmelin) — The rarity of this species in the Great Slave Lake district is so evident that it is perhaps questionable if it ever occurs in or around Slave River Delta. Nevertheless, it should be watched for. Preble (1908) refers to two specimens in the museum of of the Hudson's Bay Company at Fort Simpson that were shot near Fort Providence. The A.O.U. Check-list (1931) states that *islandica* has been recorded at Great Slave Lake.

Buffle-head *Bucephala albeola* (Linnaeus) — This is the 'wood duck' of local residents, a designation that many years ago caused the writer no small amount of concern. Local status and distribution is somewhat similar to that of the American Golden-eye. It diminishes in numbers northward below Upper Slave River, but a few birds are scattered along the lower part of the river and into the delta, as well as along the shores of Great Slave Lake. However, they never seem to be common anywhere in the latter areas.

Along the Lower Slave aerial transect data of recent years give the species an average standing of only 6.9 percent of the resident game duck aggregate. As with most species, considerable variation in relative abundance appears to take place from year to year. Throughout most of the north country this is a highly characteristic river duck. It occupies the streams immediately after the break-up in the spring and remains until the forepart of October. Young begin hatching toward the end of June.

Old-Squaw *Clangula hyemalis* (Linnaeus) — Considerable numbers of these birds migrate through the district spring and autumn. From the south the route roughly follows Athabaska and Slave Rivers to Slave Delta and other points, thence northward to the Arctic coast. Many also go north by way of Mackenzie River.

Fairbairn (1931) states that the species is "common in migration along the south shore of Great Slave Lake in September." The birds appear to enter the region in early May, become common after about the 10th, and slowly move northward again in late May and early June. On the return journey the stop-over time for incoming flocks in southern Great Slave Lake is spread along from about mid-September until well into October.

Harlequin Duck *Histrionicus histrionicus* (Linnaeus) — In the immediate territory under review this species is apparently very rare; it has eluded most observers. The only personal observation is for a full-plumaged male noted on July 8, 1932, a few miles up Buffalo River south of Great Slave Lake. Apparently the only other record for the district is that by Preble (1908): "Adult males roughly mounted, said to have been shot near the post, were obtained from natives at Fort Resolution in 1901 and 1903."

Pacific Eider *Somateria mollissima v-nigra* Gray — A rare straggler that has seldom been seen in these parts. While an essentially maritime species, a few individuals occur in the interior. Ross, in 1862, summed up the local evidence as follows: "A male specimen of this very rare bird was shot by me at Fort Resolution in 1858, and a female was obtained by Mr. Alex. Mackenzie in 1861 in the same place." (Preble, 1908). There appear to be no other records for the district.

King Eider *Somateria spectablis* (Linnaeus) The present species, like *v-nigra,* is apparently of very rare occurence. The writer knows of only one record for the district. In the summer of 1904, Preble (1908) secured the skin of an adult male from James McKinley of Fort Resolution; the bird had been taken by a native during the spring somewhere on Great Slave Lake east of the post.

White-winged Scoter *Melanitta deglandi* (Bonaparte) — As a summer resident this scoter occurs only in moderate numbers. Few were noted within the confines of the delta and on some occasions it was not recorded there at all. The species was frequently met with on the open waters of Great Slave Lake, where in some localities it is fairly common. Greater numbers inhabit Mackenzie River below Mills Lake. During migration the flocking birds appear in greater numbers throughout the district and at times appear to show a preference for the larger streams. Fairbairn (1931) remarks that large flocks were seen on Lower Slave River in September 1929. Average spring arrival appears to take place about the middle of May and final autumn departures around the third week of October.

Surf Scoter *Melanitta perspicillata* (Linnaeus) — Based on personal data, this species is far less plentiful in the delta and adjacent country than *deglandi.* However, it is common in some Great Slave Lake localities, as it is, also, rather consistently on the Mackenzie below Fort Providence. In aerial data for the Lower Slave River terrain the two scoters are lumped together and thus jointly represent about 14.0 percent of the total duck population. Sometimes large, moulting throngs are met with in summer and equally large migrating flocks during the spring and autumn. Usually, they are seen in 'rafts' on lake and stream. Times of arrival and departure are similar to those of the White-winged Scoter.

Ruddy Duck *Oxyura jamaicensis rubida* (Wilson) — This is one of the rarest species of wildfowl in the region, which amply explains its lack of detection by most observers. The only personal record is that of an adult noted in Slave Delta on July 27, 1951. This appears to be the only definite record for the delta, although by inference the two Fort Resolution occurrences presented below are linked with the nearby marshes of that area.

Preble (1908) remarks: "This species was first recorded from the region by Ross who lists it as occurring north to Great Slave Lake, and as rare. Baird, Brewer and Ridgway state that it was found breeding near Fort Resolution by Kennicott in June, and at the same place by Lockhart, who took its eggs in July."

Hooded Merganser *Lophodytes cucullatus* (Linnaeus) — This species is another rarity in this region. It was not personally seen, nor does there appear to be a single recent record by anyone. Preble (1908) lists several occurrences which project the range of the species northward to Fort Resolution, Simpson and Wrigley.

American Merganser *Mergus merganser americanus* Cassin — A sharp watch was kept for this species, as with other accidentals, but it was never personally detected. Evidently no ornithological observer has noted the bird in this region during recent times. Preble (1908) lists the species as a "rather uncommon breeder north to Great Slave Lake"; in the latter area on July 11, 1901, he saw several examples near Stone Island. The A.O.U. Check-list (1931) includes Great Slave Lake within its breeding range.

Red-breasted Merganser *Mergus serrator* Linnaeus — This merganser is fairly well distributed in the district, although occurrences are usually very spotty and irregular anywhere near the delta. It was personally seen on several occasions between Fort Resolution and Big Island and, also, on Buffalo River and Buffalo Lake. It occurs more frequently on the Mackenzie around and below Big Island and in the northern and eastern parts of Great Slave Lake.

In the latter area, Seton (1911) refers to the species as abundant, and Fairbairn (1931) remarks: "Breeds commonly on Great Slave Lake. Juveniles were still unable to fly in early September." During times of migration, at least, a few occur on Lower Slave River and presumably in the delta. The term of seasonal residence extends from about early May until at least mid-October.

American Coot *Fulica americana americana* Gmelin — Although the coot is common in the relatively nearby Peace-Athabaska Delta to the south, it is represented by only rare strays anywhere in the Great Slave Lake district. Only one personal record exists for these latitudes, that of a single adult observed in Slave Delta on July 26, 1951. Preble (1908) provides the following records: "Baird, Brewer and Ridgway state that it was taken at Fort Resolution; H. W. Jones reports the species from Hay River, Great Slave Lake." The period of local residence is not known, but in southern Wood Buffalo Park it arrives during late April or early May and remains until late September or early October.

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NOTES

A Mockingbird in Ottawa

On May 16 and 17, 1956, a Mockingbird *Mimus polyglottos* was observed in the Westwood subdivision of the western Ottawa suburbs. So far as is known, this is the first Ottawa record for this bird.

It was first seen perched on the cross piece of a child's gym set in a garden between Knightsbridge Road and Dovercourt on the morning of May 16. From there it flew down and began eating an apple which had been left there by the children. It was clearly seen by my wife (who has observed Mockingbirds in Texas), through binoculars at a distance of about 75 feet. Its character checked in all respects with the bird shown in Peterson's Field Guide, except that the chest and belly were gray instead of white. After a while it flew off, but returned again to the apple on several occasions.

That evening at about 6.00 p.m., I saw the bird myself. It was again eating the apple, but flew off, giving a good view of the V-shaped white patterns in the wing and the white-bordered tail. I also noted the dusky chest and belly and a small white area on the chin.

There was a heavy frost that night and the next morning the bird was not seen until about 9.30, when it presented a fine view of itself to my wife in good light from a fence about 50 feet away. It gave every appearance of having spent an uncomfortable night, being very sluggish.

By a fortunate coincidence, Mrs. Jack Le Geyt, of 2051 Dovercourt Avenue, is a bird-watcher as well, though unknown to the writer at the time. She had also decided that this was a Mockingbird, and reported that the bird had been eating the bread she puts out close to the windows of her house. This would give her a view of it from about 12 feet. It spent considerable time in an elm tree not far away, where it weathered at least one snow storm.

Earlier in this particular week there had been violent winds and cyclones in south-western Ontario, and it is not impossible that these winds were responsible for blowing this bird far beyond the north limit of its range.

MICHAEL SPENCER

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An Arboreal Red-backed Vole

About 1 p.m. on July 15, 1955, while walking on a logging road 60 miles east of Prince George, B.C., I saw a small reddish form running up a dead tree trunk in an open stand of white spruce and alpine fir. With the use of binoculars a few moments later I was surprised to find that what I had thought was a small bird was actually a mouse; it had reached a point 20 feet from the ground, where one fork of the tree had broken off, and was preening itself in full sunlight on a broad sliver that sloped down from the remaining trunk. Approaching the tree, I focussed the glasses again and saw that the mouse was now lying outstretched on the chip of wood in much the same pose as that assumed by basking marmots, but by the time I reached the tree it had disappeared. With a long pole I poked the mass of splinters that formed a shingle-like roof over the cavity where half of the tree had split off; one chip fell away exposing a mossy nest and the mouse appeared instantly and ran about two feet down the trunk where it stopped, head downward. With the end of the pole I touched the trunk above it, causing the mouse to run straight down the tree and into my hands as I held them against the trunk in its path. It did not attempt to bite. An examination proved it to be an adult male red-backed vole *Clethrionomys gapperi*.

The fact that the mouse had found this nest site 20 feet from the ground on a branchless tree trunk suggests that this species may be more arboreal in its habits than is commonly supposed.

JAMES GRANT

Box 740, Vernon, British Columbia

A Breeding Record of Cooper's Hawk in Alberta

On May 1, 1949, I found the partially completed nest of Cooper's hawk *Accipiter cooperi* near the southern boundary of the Dominion Forest Experimental Station in the Kananaskis River valley. It was in a dense white spruce tree growing in a shallow ravine at an elevation of 5200 feet. The female hawk was shot; the male appeared briefly but was not collected.

My next visit was on June 19 shortly after an unseasonal storm which had left five inches of snow still covering the ground. The nest had been completed and a snowball thrown in its direction flushed a female hawk which returned to swoop at me as I climbed the tree. There were four eggs in the nest, a solidly built structure of twigs lined with chips of spruce bark. A few downy feathers of Canada jay *Perisoreus canadensis* clung to nearby branches.

As this vicinity was not visited again it was not determined whether the brood was successfully reared; however this apparently constitutes the first known breeding record for the species in Alberta.

JAMES GRANT

Box 740, Vernon, British Columbia

Rock Wren at Churchill, Manitoba

On June 29, 1956, at Churchill, Manitoba, a Rock Wren *Salpinctes obsoletus* was observed by Dr. David Sergeant and John Crosby. The bird when first seen was perched on top of the grain elevator where it sang mightily in characteristic Rock Wren fashion. The song consisted of a variety of phrases, each phrase being repeated several times. Also a sharp, whistled call note was given, as well as the occasional loud, dry rattle. The bird later flew down from its lofty perch where it was observed at close range. All field marks were clearly visible, such as the faint breast streaks and the whitish-buffy tips on the tail feathers. The bird was seen again by Crosby on subsequent visits to the area on July 4 and July 7. From July 5 to July 23 the wren was also seen and heard daily in this area by Eva Beckett.

After Crosby's departure from Churchill on July 12, the bird was kept under observation by Beckett. On July 18 another Rock Wren was seen by Beckett. Both birds were seen together in full view and all field marks were plainly visible. On August 1 a Rock Wren was seen carrying food near a pile of old timbers. This spot was about 100 yards north of the point where the male was frequently found singing. On this occasion the bird was disturbed by the observer's presence and perched some distance away. After a few moments, the bird disappeared, with food, among the loosely piled timbers. The bird was observed making two more trips with food. On the morning of August 2 the wren was still carrying food. On August 3 the bird appeared to be in a state of great anxiety at Beckett's approach, but no young were found. No wrens were seen in the area on August 4 or thereafter.

The National Museum records show an interesting observation of Rock Wren at Chipewyan in northern Alberta on June 12 and 17, 1914, by Francis Harper (MS.). This locality is about the same latitude as Churchill, Manitoba.

JOHN CROSBY and EVA BECKETT

New Manitoba Record for the Short-tailed Shrew

Although I have collected small mammals at The Pas for several years, I have only recently learned of the presence here of the short-tailed shrew *Blarina brevicauda manitobensis* Anderson. The specimen came from an unexpected source. It was accidentally taken in a wood shed in town near the hospital, Lot 14, Block 35, Plan 487, in a trap set for mice. The writer extends his sincere thanks to Mrs. P. S. Ridings, Sr., for saving the specimen.

The shrew was taken on May 24, 1951, and was almost certainly a male. It was partly decomposed internally so that an exact sexual determination was not possible. External measurements of the specimen give the following data: total length, 121 mm; hind foot, 17 mm; tail, 22mm. Skull measurements: condylobasal length, 22 mm; cranial breadth, 12 mm; palatal length, 10 mm; greatest palatal breadth, 6 mm; maxillary breadth, 7.6 mm; and maxillary tooth-row, 8.6 mm.

About one third of the end part of the tail is covered with white hairs. This is seemingly a localized albinic tendency and is of no special taxonomic significance.

The present record extends the known range of this subspecies some 60 miles northward in Manitoba. Till now the most northern Manitoba record was that of J. Dewey Soper made at Overflowing River several years ago.

The specimen is in the writer's private collection at The Pas (No. 100).

I wish to thank A. W. Cameron of the National Museum of Canada, Ottawa, for confirming my determination of this subspecies. The writer also extends his thanks to Edna and Fleet G. Whitaker for their exact localization of the spot where the specimen was taken.

WALTER KRIVDA

The Pas, Manitoba

Some Northern Limits of the Western Chorus Frog

Bancroft, in Hastings County, Ontario, seems to be near the northern limits of the little western chorus frog *Pseudacris nigrita triseriata*. A line drawn on the map from west of Coe Hill to Bancroft, then easterly to beyond Detlor, would show this division. To the south, the frogs can be heard in most ponds and marshes in the breeding season, but to the north there are only scattering calls near the line. Logier and Toner (Can. Field Nat. 57:104-105, 1943) show that it is absent in the north of Simcoe County but do not indicate the range to the east. A. S. Rand (Can. Field Nat. 58:68, 1944) has taken specimens near Ottawa, but how far these frogs penetrate into Renfrew County up the Ottawa Valley is unknown. Detlor, where I heard them singing, is only a few miles from the southwest boundary of Renfrew County and is drained by a creek of the Ottawa river system. Neither height above sea level nor temperature seems to be the limiting factor, for frogs are found at higher elevations to the south of the line than occurs to the north, and temperatures over the whole region vary greatly. It is probable that the lower land in Renfrew County would have a higher mean temperature than would northern Hastings County. Until more is known of the ranges and the habits of this frog any attempt to map its distribution would only be provisional.

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REVIEWS

Insect Fact and Folklore

By LUCY W. CLAUSEN. New York, The Macmillan Company, 1954. 30 fig., 194 p. $3.50.

In this little book, Dr. Clausen combines a simplified account of the biology and classification of insects with a recitation of interesting facts, myths, and customs concerning them. It is a layman's rather than a scientist's book; nevertheless, the professional entomologist will read here many things, mostly from the realm of folklore, that are new to him.

Following an introductory chapter in which she defines insects and explains something of their structure, abundance, and general classification, Dr. Clausen devotes thirteen chapters to major groups of insects, with a concluding chapter on progress in entomological science. Chapter 2 on the moths and butterflies is typical. Commencing with a brief definition and description of Lepidoptera, the author tells the reader of the Hopi butterfly dance, giving the words of the accompanying song; of the urticating hairs of certain moth larvae; of edible caterpillars; of weather predictions based on the band width of woolly bears; of Mexican jumping beans; of silkworms; or myths associated with moths; and of the migrations of butterflies. The chapter concludes with a selection of proverbs mentioning Lepidoptera, a number of fables and superstitions, and a reference to the appearance of Lepidoptera on postage stamps. This pattern is repeated with accounts of the beetles, the cockroaches and their relatives, the true flies, the bees, ants, and their relatives, the true bugs, and some of the smaller orders of insects. The reader is told of the sacred scarabs of Egypt; of the roach *Supella supellectilium* that has already become adapted to a life in television sets; of the development of galls in plants; and of the use of 'flea-furs' on the shoulders of well-born ladies in the sixteenth century. A legend of the Ainu of northern Japan that explains the origin of mosquitoes and other biting flies from the ashes of the burned body of a one-eyed man-eating hobgoblin is reminiscent of the legend of the Kwakiutl Indians of coastal British Columbia in which it was the blind cannibal giantess Dsonogua who was burned to ashes with similar results.

The book is somewhat marred by a number of minor slips and inaccuracies, for example the statements that the cabbage butterfly is yellow, and that the famous migration of the monarch butterfly starts "in isolated parts of Alaska." Also the reviewer has been unable to substantiate the supposition that the 'bot-fly' of caribou is *Hypoderma lineata,* the common warble fly of domestic cattle, or the statement that female mosquitoes cannot live without a blood meal.

Despite its defects which are mainly small inaccuracies of detail, this is a pleasant and useful little volume that will afford the reader many pleasurable hours.

G. P. HOLLAND

The Birds of Massachusetts

An Annotated and Revised Check List by LUDLOW GRISCOM and DOROTHY E. SNYDER. Salem, Mass., Peabody Museum, 1955. 295 p. $3.75 paper, $4.75 cloth.

Massachusetts has a wide variety of habitat types that attracts within its borders a correspondingly long list of birds. Moreover, few parts of this continent have been so long and intensively studied. The senior author has been observing birds there since 1899, the junior author since 1935. In addition, they had access to a mountainous mass of data in the notes, collections and publications made before their time by other notable ornithologists; thus they are enabled to present a good picture of bird populations and their changes over a period extending back a century or more.

This is an annotated list of Massachusetts birds but it is no ordinary list. No less than 430 avian species and subspecies are known conclusively to occur, or to have occurred, in the state, while an additional 51 are dealt with in the hypothetical list. Information, mainly on local distribution and relative abundance, is succinctly presented and superbly documented. The authors have used the strictest of criteria, explained fully in the introduction, for admitting species to the list, criteria that might be studied with profit by all on whom falls the often painful duty of screening records for publication.

This list, perhaps the best of its kind yet produced on this continent, transcends the ordinary functions of an annotated list. Its record of a century of change is useful information for anyone interested in avian population dynamics. The cutting of forests, the rise and decline of agriculture, draining of marshes, overshooting, legal protection, and amelioration of the climate, to name a few of the factors affecting Massachusetts bird populations, have been good or bad but rarely indifferent. Numbers of some species have increased, many have declined, and others have fluctuated drastically. Certain species have spread into the state and established breeding populations; others have been introduced by man. A few have passed into extinction.

W. EARL GODFREY

High Tide and an East Wind, the Story of the Black Duck

By BRUCE S. WRIGHT. Harrisburg, Pa., The Stackpole Co. and Washington, The Wildlife Management Institute, 1954. Line drawings, photographs and sketch maps; 162 p. $4.50.

This book contains the results of a five-year waterfowl research program and its principal object is to serve as a basis for black duck management in eastern Canada.

The author commenced his studies in the summer of 1945 and most of the data were obtained on a 32,500-acre study area in lower St. John River valley below Fredericton, N.B. Other less intensive work, including a banding program, was carried out in southeastern Quebec, Labrador and Newfoundland. An extensive search of the literature provided additional information from all parts of the black duck's range and makes this publication the most complete yet to appear on an eastern waterfowl species.

The first five chapters deal with life history and ecology on a seasonal basis. The spring flight, nesting, the brood period, late summer behavior and fall migration, including the hunting season, are described. Data on food, cover requirements, and mortality are included for each season. The remaining two chapters are concerned with general distribution and management.

The book is designed for a wide range of readers and is written in nontechnical language that makes it especially attractive to the sportsman. Some readers may be disappointed that the methods and findings of the waterfowl program are not treated in greater detail. Perhaps a complete section of the book devoted to the study itself or the addition of end-of-chapter summaries might have been an improvement.

The lower St. John River valley, although the largest unit area of waterfowl habitat in the Maritime Provinces, should not be taken as representing the region as a whole. There are many large areas of brackish and estuarine marshes, especially in Nova Scotia and Prince Edward Island, which are highly productive and cannot be left out of any discussion of black duck management in eastern Canada. Those areas should have received more attention in the present work.

Other points of criticism include some contradictions and the author's tendency to make categorical statements on the basis of rather flimsy evidence. One contradiction is apparent in the application of brood survival data. On page 48 the average brood size for Class II (half-grown) ducklings is tabulated as 5.7. The average size of Class III (flight age) broods, appears in the same table as 6.3. This apparent increase in size for broods in the later age group is stated by the author to be "accounted for solely by practice of the accumulation of ducklings" (from deserted broods). It would appear that the average number of ducklings surviving to flying age could not be more than 5.7 *per brood,* yet in a life table (p. 105) 6.3 is given as the survival figure for October 1.

On page 33 is stated: "Thus 1.33 days is the time required for one egg to pass through the oviduct and out through the cloaca." Reliance, here, is placed on one observation quoted by Bent in 1923. Recent findings show that the normal laying rate of ducks is one egg per day. My own observations indicate that the black duck follows this pattern. It would seem that any departure from the rate of one egg per day would likely be the result of disturbance to the laying bird causing her to drop her egg outside the nest, or perhaps even the removal of an egg by a predator.

In spite of the above-mentioned faults and some others of a similar nature, this book contains a great deal of information, much of it new, from all parts of the black duck's range and from the St. John River estuary in particular. Mr. Wright's discussions and proposals on management are particularly interesting and thought-provoking. I am sure that the author's views on the importance of restocking of certain habitats as a possibility in breeding ground management will provide a stimulating point of discussion both pro and con among eastern waterfowl managers.

The photographic illustrations are especially good and the excellent drawings by Peter Ward add much to the attractiveness of the book. It is highly recommended to all persons interested in the waterfowl of eastern North America.

GEORGE F. BOYER

North American Moose

By RANDOLPH L. PETERSON. Toronto, University of Toronto Press, 1955. 66 fig., 280 p. $12.50.

The appearance of this comprehensive treatment of the North American Moose will be welcomed by biologist and big game hunter alike. It is largely a compilation of the available published information on this species supplemented by the author's own studies conducted in Ontario. That the literature has been thoroughly searched is obvious from the extensive bibliography, which is, in itself, invaluable.

The chapter and sectional headings indicate the scope of the book: taxonomy and distribution, paleontological history, postglacial dispersal in North America, population status, reproduction, life history, behavior, food habits and food plants, habitats, relationships with other animals, and management. Tooth wear as an index of age, written in co-operation with R.C. Passmore and A.T. Cringan, is included as an appendix, as is another paper by Cringan entitled "Studies of Moose Antler Development in Relation to Age."

The sections dealing with moose ecology are by far the most comprehensive in the book, probably because much of the material is based on Dr. Peterson's own studies. In dealing with such topics as food habits, behavior and habitat preferences, the author writes with greater ease and clarity and obviously with greater confidence than is the case with other topics. Most of the remainder of the material is taken from scattered published sources, which, as most compilers know only too well, often tend to be fragmentary and sometimes contradictory. To condense and synthesize this material is no simple task and if the style is sometimes awkward and the sentences disjointed, it is largely because the original material would allow no stylistic polishing without the usurpation of editorial liberties.

One of the more interesting chapters, from the point of view of this reviewer, is that dealing with the postglacial dispersal of the moose. The author supposes that the races *americana* and *andersoni* evolved in separate refugia during glaciation, and this may well be true. However, the period of isolation must have been either only partial or of brief duration, since the two races do not differ greatly. Quite possibly, *andersoni* represents an intermediate form which arose when *gigas, shirasi* and *americana* mingled and interbred, following the retreat of the ice, in the areas of contact. The intermediate nature of the characters which distinguished *andersoni* from the other races strongly suggests this.

The taxonomic discussion is a summary of a previous paper by the author and treats all the recognized forms of the genus *Alces*. The absence of any reference to the "Checklist of Palaearctic and Indian Mammals" by J. R. Ellerman and T. C. S. Morrison-Scott (1951) is surprising since these authors treat the North American moose as conspecific with the Old World elk *Alces alces*. This book predates Dr. Peterson's paper "A Review of the Living Representatives of the Genus *Alces*," in which he arrives at the same conclusion.

Both the author and the publishers are to be complimented for the excellence of this volume, which will be a standard reference for many years to come.

AUSTIN W. CAMERON

A Revision of the North American Caddisfly Genus *Banksiola* (Trichoptera: Phryganeidae) *and* The Kitagamiidae, a Family of Caddisflies New to North America (Trichoptera)

By GLENN B. WIGGINS. Toronto, Royal Ontario Museum, 1956. 12 p. and 10 p. 75 cents each. (Contributions of the Royal Ontario Museum, Division of Zoology and Palaeontology, Numbers 43 and 44)

These are two more of the excellent series of studies of North American caddisfly groups by Mr. Wiggins. Both text and illustrations are of high taxonomic quality, and reflect the industry and throroughness of the author. The revision of *Banksiola* clarifies the status of several common Canadian caddisflies and defines their relationships to some extralimital ones. The second paper sheds most interesting light on an unusual Californian species.

EUGENE MUNROE

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BIRDS IN CUMBERLAND PENINSULA, BAFFIN ISLAND

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Received for publication 14 August 1956

INTRODUCTION

THE INLAND parts of Cumberland Peninsula on the east coast of Baffin Island were largely unknown till recent years, as the earlier explorer naturalists had either visited the fringes of the area or traveled through it only in winter. Cumberland Sound was a base for Ludwig Kumlien (1879), the first naturalist to work here, and later for the journeys of Hantzsch (1930). The interior remained unexplored till Franz Boas accomplished the sledge crossing from Kingnait to Padle during his stay in the Cumberland area, 1883-84 (Boas, 1885). Pangnirtung was also the main base for J. D. Soper who carried out extensive journeys of exploration, including a sledge crossing of Pangnirtung Pass. Soper published important papers (especially 1928, 1946) on the ornithology of south Baffin Island. A general history of this area was edited by Millward (1930).

In 1953 the Baird Expedition spent a summer in the mountainous interior of the peninsula at about 67°N. The party traveled to Frobisher Bay by plane on May 12, and then to the expedition base at Pangnirtung in a chartered airplane which was later used to place a number of camps in the mountains of Penny Highland(Baird, 1953).

On May 18 the airplane flew the geologist D. J. Kidd and the writer to Padloping Island on the Davis Strait coast. From there a two-week journey was made by dog sledge to the outer coastal islands, notably to Cape Searle Island and to the head of Padle Fjord. The mountains were then crossed by way of June River to the biological base (Bio. Camp) in Owl Valley. Seven weeks were spent there, two weeks at Base Camp further into the mountains and a final period at Bio. Camp before its evacuation at the end of August. We stayed a week at Pangnirtung in early September.

I am grateful to P. D. Baird for inviting me to join the 1953 expedition, and to the McGill University-Carnegie Arctic Program for arranging a grant for my participation. Thanks are due several members of the expedition who supplied useful bird observations, especially F. H. Schwarzenbach for analyzing the vegetable part of the food contents of some specimens (Appendix). V. C. Wynne-Edwards kindly gave me a record of observations in the area covered by this paper, during his journeys, made independently of the 1953 Baird Expedition, along the Baffin coast in July-September 1953. Acknowledgment is given to the Arctic Institute of North America for permission to use the map from Baird (1953), to D. J. Finney who advised on statistical analysis, and to James Fisher for help on Fulmar literature. Lastly I am greatly indebted to V. C. Wynne-Edwards for his many suggestions and help, especially in reading this manuscript.

TERRAIN AND VEGETATION

The biological center (Fig. 1) was in Owl Valley, part of the great trough of Pangnirtung Pass which lies across the peninsula from Cumberland Sound to Davis Strait. The pass cuts through spectacular mountains which extend to a general height of 1500-1800 meters for the whole width of the peninsula. Glaciers are numerous, pushing their moraines into the main valleys and reaching the sea in places, and the areas of high ground are covered by large ice caps. The largest, Penny Ice Cap, slopes gradually from a height of 2000 m to the flatter country of low rock hills to the west and south. Compared with the Nettilling Lake and Foxe Basin plains to the west and the Frobisher lowlands to the south, Cumberland Peninsula has very little low ground, most of it in the deep mountain valleys. Owl Valley had broad flats over a mile wide, of gravelly muddy and sandy river deposits and a sweep

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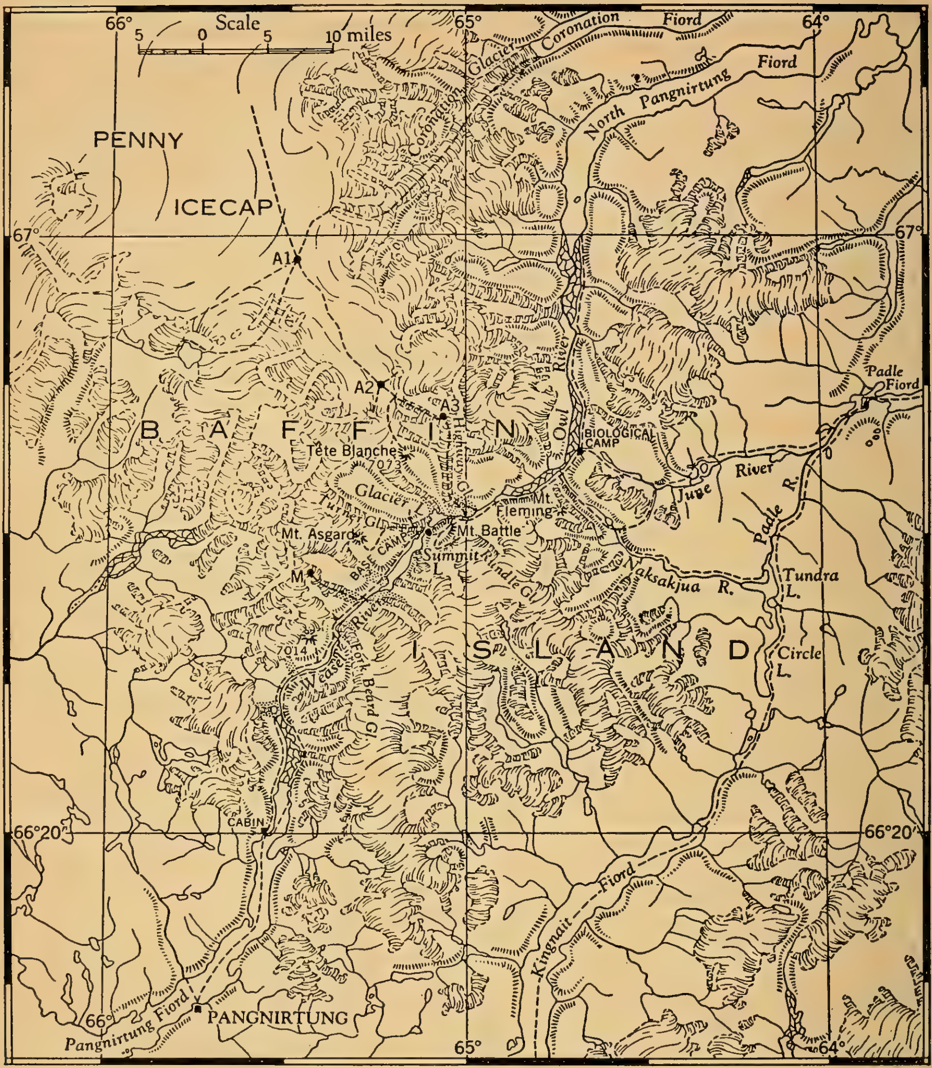

FIGURE 1. Map of Penny Highland area. (Reproduced from *Arctic*)

of wet grassy tundra with occasional ponds and lakes, rising to areas of heath and then barren stone fields on the hillsides at 500-600 m. Bio. Camp was placed at 180 m altitude about 15 miles from the fjord head to the north. Base Camp was at the summit of the Pass at 400 m.

In June and Naksakjua valleys, both connected to Owl Valley by high passes, chains of lakes led down through more rolling mountains to the wide grassy Padle Valley. In these valleys the limit of continuous vegetation was higher than in Owl Valley, the heath vegetation richer, and the berry seasons of 1952 and 1953 more prolific. Some species of plants found there were absent from Owl Valley, a few of them relict indicators of a past warmer period (Schwarzenbach, in Baird, 1953). The insect and spider fauna was also probably richer there, containing greater numbers of individuals as well as more species. Dating studies showed that Owl Valley had been invaded by vegetation only in the last 150 years. On the sledge trip I found this rich heath extending in places far down Padle Fjord almost to the outer coast.

Vegetation cover was fairly continuous up to about 400 m on west-facing slopes of Owl Valley, and to 500 m on east-facing and 600 m on west-facing slopes of June Valley. Schwarzenbach gave a brief account of the vegetation in Penny Highland, and a report on the vegetation at Pangnirtung was made by Polunin (1948).

CLIMATE

The general climatic conditions of south Baffin Island have been described by Soper (1946) and records at Pangnirtung summarized (Polunin, 1948). The meteorology of the expedition's ice-cap camp and Base Camp was reported by Orvig and Bonnlander (in Baird, 1953). The area enclosing Bio. Camp and the neighboring June and Naksakjua Valleys received much more sunshine and less cloud and precipitation than the Fjord to the north and the Base Camp area at the top of the pass to the south. In South Pangnirtung Fjord and Weasel Valley, snow cover was relatively light and had mostly gone as early as May 14-18. The rest of the pass was also early clear of snow, in Owl Valley by the second week of June, and Owl River was by then free of ice up to 25 miles from its estuary. Though the lakes were still frozen over then, the ice disappeared rapidly in the last week of June. Eastwards, towards June River and the outer coast, the snow cover was much more extensive, almost entire on May 19 and still almost unbroken above 150 m in June Valley in the second week of June.

After an unusually warm sunny spell in early May, colder conditions arrived, and the last week of May and first three weeks of June were marked by considerable snowfalls, sunless and windy days, and frosts almost every night. Warmer sunny weather lasted from June 20 till a cold spell brought snow to 300 m in the third week of July. There was no ground frost after the first week of July. After the July cold spell, largely rainy foggy weather persisted till the first heavy winter snowfall in the third week of August; by then most of the birds had gone. On the whole the summer was poor, especially the month of June. The berry crop in both June and Owl valleys was much smaller than it had been in 1952, as judged by the berries remaining from 1952 when the snow melted in early summer.

ANNOTATED LIST OF BIRDS OBSERVED

1. COMMON LOON *Gavia immer* (Brünnich). On June 1 loons were heard often at the lower lake in June Valley and at least three were seen in the distance, but I was unable to be sure of the species and they may have been *G. pacifica*. One Common Loon was seen close at the middle lake, then almost completely ice-bound, on June 2 and several other loons (sp. ?) were heard there. There was again one at the upper lake on July 3, then still a quarter ice-covered, possibly the same bird next day, and on August 21 again one at the upper lake. An Eskimo skin rug made of two locally-obtained skins of this species was seen at Pangnirtung in September, and similar mats were seen there by Shortt and Peters (1942). Kumlien (1879) recorded it common and breeding in Cumberland Sound. Two were noted on South Pangnirtung Fjord by Soper (1928) who also found them common and breeding on Nettilling Lake west of the head of Cumberland Sound. They have been found common well to the north of the Cumberland-Nettilling area, on a part of the Foxe Basin coast (Manning, in Bray, 1943).

There was no evidence of breeding of the loons in June Valley and most of them had gone by early July. On June 2 their calling continued almost without interruption throughout the night; next day they were more quiet, and no calls were heard in July.

2. RED-THROATED LOON *Gavia stellata* (Pontoppidan). The only loon seen in Owl Valley, and there were none on the June Valley lakes where the Common Loon was found. The first were four on the Padle estuary, June 3. In Owl Valley they were already paired by June 12 though the ice had then only begun to break on the lakes; they spent much time on Owl River which was ice-free, and were seen feeding on Arctic Char *Salvelinus alpinus*. In mid-June their cackling calls could sometimes be heard at any time of the night.

Though frequently seen in display, two out of three closely watched pairs made no attempt to breed. One pair, with a nest and two eggs on June 26, may have deserted as there was only one egg on June 29 and no sign of the birds. On July 8 the nest was empty and all the loons in the valley had gone. One was at a pond at North Pangnirtung Fjord, July 16. Wynne-Edwards found a nest with two eggs at Sinyah, Cumberland Sound, July 29.

3. FULMAR *Fulmarus glacialis minor* (Kjaerbølling). The immense Fulmar colony, (Qaqodluin to the Padloping Eskimos) at Cape Searle was described by Wynne-Edwards (1952a, b). The geology was briefly reported by Kidd (in Baird, 1953).

Kidd, the Padloping Eskimo Samo, and the writer traveled to Cape Searle by dog sledge on May 22, almost to a day the same time of year as when Boas (1885) first passed by sledge between Padloping Island and the Cape in 1884. We stayed on the island for five days. Though most of the land around Padloping was then covered by nearly unbroken snow, most of Cape Searle was snow-free. Except in the gullies there was little snow on the cliffs which are probably too steep and exposed to hold much snow, and even the tops of the great towers were clear apart from cornices at the edges. Probably the Cape has a favorable microclimate; *Saxifraga oppositifolia*, *Salix arctica*, *Draba* sp. and *Oxyria digyna* were all in flower on May 23, far ahead of those inland. A continuous cover of sea ice six feet thick extended all round the island and three miles out to sea. Farther out a stretch of pack ice and open water, which held many icebergs moving south, ran along the coast, and beyond it a great white ice cover to the horizon. From the ice it was easy to see all parts of the colony except the tops of the inner and outer towers. Part of the inner tower summit was visible from the west; its green top was so densely packed that it was tinged gray with thousands of Fulmars, and there were hundreds more sitting on the snow of the cornices. The outer tower was even more densely packed.

In August 1950, Wynne-Edwards (1952b) estimated there were 200,000 Fulmars present, adding (p. 359) "the estimate should be accepted only as a well-considered guess, likely to be correct within a factor of two in either direction." When we arrived it seemed clear that the number must be very much less than even 100,000. As the difference appeared too great to be accounted for by any personal differences in estimating, careful counts were made. I estimated that not more than 25,000 were present on the actual cliffs.

Though there is no observed evidence of widespread nonbreeding at Baffin colonies, it is possible, as suggested by Fisher (1952), that many may not breed in years of extensive ice cover on the feeding grounds of Baffin Bay and Davis Strait. Comparison of gonad measurements of Cape Searle specimens (Table 1) with those of breeding Scottish birds recorded by Marshall (1949) shows that the Cape Searle males were probably in breeding condition at the end of May; the females were not, as judged by the small size of the ovaries and oocytes and their relatively undeveloped oviducts. Spring and early summer 1953 were certainly marked by extensive ice on the sea; there was 80-100 percent ice cover from April till early June along the north side from Padloping - Cape Dyer to 120-150 miles out from Cape Searle. The Murres and Black Guillemots were probably also late in returning to this area.

Furthermore in Shetland colonies a pronounced drop in numbers has been observed during May before egg-laying time (Venables, in Fisher, 1952); up to 50 percent may go to sea then, returning at the end of the month. At Cape Searle an indication that the numbers at sea were very great was evident in the vast stream of Fulmars sometimes to be seen passing to and from the cliff in ESE-WNW directions; over 2,000 were once counted arriving from the sea in 15 minutes.

Though much display was seen, there was no evidence of any egg laying, as late as May 27, by many Fulmars disturbed from their nesting sites. In 1950 Wynne-Edwards judged from the size of the chicks that most eggs had been laid about the second week of June, and possibly a few a week earlier. The start of the breeding cycle in the high-arctic is probably one or two weeks later than the better-known cycles (Fisher, 1952) elsewhere.

The Fulmars of this area are predominantly of the dark phase, and in a sample counted by Wynne-Edwards at the Cape in 1950 only 13 percent were light birds like typical British individuals. Of 446 counted by the writer 79, or 17.7 percent, were light. But there was such a complete range in color shades that any classification could be only arbitrary. A similar situation was found on Bear Island by Duffey and Sergeant (1950) who also stressed that the apparent shade varies with daylight intensity. At Cape Searle, where even on dull days the light was dazzling, reflected from the vast snow and ice fields on every side, many individuals counted as 'light' probably also included many in grade L of Fisher's classification (1952) of four main color types. In a total of 14 Cape Searle birds and one Cumberland Sound bird that I examined in the hand, 2 were graded LL, 1 was L, 7 D and 4 DD, probably a fairly typical sample.

These measurements give further evidence of the short-billed group *minor*, described from north Baffin specimens by Salomonsen (1950), and later recognized in other Baffin specimens (Wynne-Edwards, 1952c). In a total of 52 now measured from this area, 37 males with a range of 33.2-39.0 have a mean culmen length of 36.2 mm and 15 females with

TABLE 1. CAPE SEARLE FULMARS

DATE	SEX	FISHER'S PHASE CLASSIFICATION	WING (MM)	BODY WEIGHT (GM)	CULMEN (MM)	GONAD—MEAN LENGTH × BREADTH (MM)	DIAMETER (MM)	
							LARGEST OOCYTE	OVIDUCT
May 24	♂	D	325	710	36.1	14.4 × 10.4		
"	♀	LL	312	570	32.6	Ovary 15 × 10	3.8	
"	♀	LL	314	580	34.4	Part destroyed	3.6	
May 26	♀	D		580	33.0	Ovary 18.2 × 14.4	3.5	9.6
"	♀	D	320	580	33.6	" 18.4 × 14.5	3.5	8.5
"	♀	L		570	34.5	" 17.1 × 15.5	6.1	11.5
"	♂	DD		725	36.0	14.5 × 11.0		
"	♂	D		725	37.0	12.5 × 8.3		
"	♂	D	326	725	34.9	Destroyed		
	♀[1]	D	Molt	595	32.8			
Aug. 15	Probable ♂[2]	DD	325		36.1			
May 26	?[3]							

[1] By Wynne-Edwards at 64°25′ N, Cumberland Sound.
[2] By D. V. Ellis at Padloping Island.
[3] Old skeleton. Skull + bill length 88.2 mm.

TABLE 2. LABRADOR FULMARS

SEX	CULMEN (MM)	WEIGHT (GM)	FISHER'S PHASE CLASSIFICATION	WING (MM)
♀	35.7	692	D	318
♂	36.1	803	DD	332
♂	40.7	829	L	327
♂	36.0	717	D	322
♂	39.0	654	D	317
♀	36.9	643	D	329
♀	34.3	711	D	319

a range of 31.0-35.5 a mean of 33.3 mm. The difference between the means is 2.9 mm.

Fisher (1952), considering the evidence insufficient to justify acceptance of the new subspecies, suggested there might be a cline in bill length from Baffin-Greenland-Atlantic. A series of July specimens from Cape Chidley and north Labrador, already described by Gross (1937) have measurements that indicate mixed or intermediate origin. The bill and wing measurements of seven of these specimens, now at Aberdeen, were taken by the writer (Table 2).

The light male with culmen 40.7 mm and the dark male with culmen 36.0 mm indicate the extent of the great variation in this small series. Though the mean culmen length (38.0 in male, 35.6 in female) is larger than in Cape Searle specimens, this may be partly inflated by the presence of large-billed Atlantic types. The body weight may also be intermediate but the sample is too small to show any real difference, and as there is no breeding colony in that area even their origin is uncertain. Birds there may be from Baffin, Greenland, or even the Atlantic, as also occurs further south on the Newfoundland banks.

It is still not known for certain if the West Greenland breeding Fulmars are intermediate between the Baffin and Atlantic populations. Many birds collected there were unsexed, or not shot at a breeding colony (Salomonsen, 1950). As an example, the specimens collected in Melville Bay by Stone (1892) may have been Baffin birds from across Davis Strait; the measurements suggest that there is not a real

TABLE 3. BODY WEIGHT IN BAFFIN AND ATLANTIC FULMARS (GM)

	MALES		FEMALES	
	CAPE SEARLE	ATLANTIC	CAPE SEARLE	ATLANTIC
Number	5	8	7	5
Range	710–740	689–936	565–595	661–795
Mean	725	835	577	731
Difference in means	110		154	
Standard deviation	9.5	70.3	9.2	46.4
	Significant at 1% level		Significant at 0.1% level	

difference between them and Cape Searle birds, and furthermore dark birds (three out of eight were dark) are very rare as breeding birds in West Greenland (Salomonsen, 1950). Larger numbers of specimens taken at the breeding colonies, especially in West Greenland, should elucidate the problem.

It was originally suggested by Wynne-Edwards (1952c) that the body weight of Baffin Fulmars is probably less than in the Atlantic birds; sufficient data are now available for a statistical analysis (Table 3).

In the males the chances are 100 to 1, in the females over 1000 to 1, against these differences being due to chance. The analysis clearly shows that a real difference in body weight exists between the two populations. However the apparent high significance should not be overestimated till more is known about variation in weight at different times of year. Certainly the Cape Searle females in May were all very fat and probably near full weight. The larger standard deviation of the Atlantic samples reflects their greater variety in date and place of origin. Six of these were Scottish birds from breeding colonies in winter, and four light individuals from Newfoundland and Nova Scotia banks which in bill size were also undoubtedly Atlantic birds (Wynne-Edwards, 1952c). Since then three more specimens taken in summer from Scottish colonies are included in the above list.

Fulmars from Spitzbergen-Norway probably have body weights similar to those of British Fulmars; Montague (1927) recorded the average weight of specimens in Spitzbergen (unsexed) as 26.7 oz (757 g) and Løvenskiold (1947) in the Norwegian handbook noted 642-1000 g.

4. WHISTLING SWAN *Olor columbianus* (Ord.) On July 31, seven swans, which were probably of this species, flew south past Base Camp along the watershed of the Pass. Kumlien (1879) recorded that swans (sp. ?) occur occasionally in southern Cumberland waters, and they were reported to him from Nettilling Lake. Neither Hantzsch nor Soper saw any in this area, though Soper (1928) saw flocks of birds that were probably swans at both Cape Dorset and Pond Inlet.

5. CANADA GOOSE *Branta canadensis* (Linnaeus). Nesting was suspected on June 20 when one was flushed at 50 yards range from a bog in Owl Valley near the Highway Glacier moraine. The goose flew around some time, finally alighting in the bog only 200 yards away, but search failed to reveal a nest. On June 22 four were resting on the river bank near the Bio. Camp. On June 25 there was one on a lake near there along with four Snow Geese; after disturbance they all flew north out of sight down the valley.

6. SNOW GOOSE *Chen hyperborea* (Pallas). See under Canada Goose.

7. OLD-SQUAW *Clangula hyemalis* (Linnaeus). Three pairs seen in Owl Valley, the first on a small ice-free pond, June 15. Though pairs were often seen in display till June 27, none bred and all had gone by early July.

EIDERS *Somateria* sp. It was often impossible to identify the species of eider seen. A male and a pair flew east along the shore at Cape Searle, May 27. On May 29 a long string of about 50 eiders, about half adult males, flew north from the fjord leading to the great Mount Raleigh peaks south of Padloping. A female or immature was sitting on an ice floe on a lake in June Valley at 300 m on July 2, and another on the lake at Base Camp at 390 m, over 20 miles from the nearest fjord, on August 1. About 60, just under half adult drakes, flew down Owl Valley, following the river, on July 14.

8. KING EIDER *Somateria spectabilis* (Linnaeus). On July 17 there were 192 on a large lake in Owl Valley; 7 were adult drakes, 9 immature drakes with white breasts, and the rest females and other immatures. When disturbed they flew north to the fjord. Next day there were six, including one adult drake, on a lake near Bio. Camp. Clearly in mid-July the Pangnirtung Pass was a good low-lying route through the mountains for numbers of eiders moving to the east coast. A remarkable eastward migration, almost all by adult drakes, was witnessed at Clyde in the latter part of July and early August 1950 (Wynne-Edwards, 1952b) at one of the lowest watersheds in that part of Baffin Island; they were believed to be moving to molting grounds in West Greenland. Great flocks of females seen near Clyde in mid-August another year led Dalgety (1936) to believe it had been a nonbreeding year. Though the numbers that I saw in Cumberland were small in comparison, the high proportion of female eiders at such early dates suggests that some nonbreeding probably occurred in 1953 also.

9. RED-BREASTED MERGANSER *Mergus serrator* Linnaeus. A pair on Padle River delta on June 3, a female on a lake in June Valley on July 2, and a female on a lake in lower Owl Valley on July 17. It has been noted in small numbers on Nettilling Lake (Soper, 1928).

10. GYRFALCON *Falco rusticolus obsoletus* Gmelin. At Cape Searle, on May 23, Kidd saw a sharp-winged large white bird with dark spots, in fast flight at the top of the island; this can only have been a white Gyrfalcon. A dark female was on the river bank in Owl Valley on July 14, and a dark male near Bio. Camp on July 17. A gray-colored paler one was watched at Blacklead Island by Wynne-Edwards on August 6, resting on ice cakes by the shore. A white juvenile specimen killed at Padloping Island on August 25 was kept by Ellis; its stomach contained remains of *Dicrostonyx*.

11. PEREGRINE FALCON *Falco peregrinus* Tunstall. Peregrines were more plentiful than Gyrfalcons. A pair, first seen on June 9, bred on a south-facing cliff about 150 meters' altitude above the upper lake in June Valley. On August 21 at least three young could be seen, just able to fly. One of the adults was watched in a series of stoops after a flying pipit, which it failed to catch. During our stay in Owl Valley occasional individuals of both sexes were seen in passing, but none was found breeding. A brood was reared in lower Weasel Valley, seen there by Röthlisberger and Thompson in August. A pair also reared a brood of probably three young on the gull cliff opposite Pangnirtung, where the adults and young were flying about on September 3.

12. ROCK PTARMIGAN *Lagopus mutus rupestris* (Gmelin). Ptarmigan were generally rare in Cumberland Peninsula in the summer of 1953 and were also scarce at Frobisher. They were reported by Constable Van Norman to be common at Frobisher in January, when they were feeding on windswept slopes near the sea in large packs. By May 13, though local Eskimos were still shooting many, they had decreased greatly, and I saw none in a walk of three miles. Later in June and July, Ellis also found them uncommon in this area. At Pangnirtung only three were seen on several long walks in the nearby hills in May, and not more than 12 on two long walks there in September.

Though reported uncommon at Padloping they were more numerous in this coastal area than on the inland heaths. On a small island near there two males flew past in chase on May 27 and in the next two days two pairs and an unmated male were found within a square mile. Several more males were seen along outer Padle Fjord in early June. In Penny Highland they were very uncommon. One pair bred at Base Camp and fresh tracks were seen by W. H. Ward at a pass on the Penny Ice Cap at 1600 m on June 22. During many long walks on suitable habitat in Owl and June Valleys, none was seen and only three were heard, though numerous white feathers on the ground indicated that they had been more numerous there in the previous winter or spring.

On May 13 a female at Frobisher had begun the molt to summer plumage on the wing coverts. The molt is extremely rapid and by the end of May all of three females were in heavy molt, the earliest with few white feathers left. All males looked pure white till well into June, and even about June 19 two males had only a few scattered dark feathers over the much-soiled winter plumage. The great sexual difference in the summer molt of the arctic ptarmigan was described by Salomonsen (1939). A male shot on August 1 is in transition between two molts, as there are still a few gray 'autumn' type feathers retaining the sheath, alongside larger numbers of white winter feathers growing on the rump and head as well as on the under parts.

Broods of 2 and 5 young were found by Ellis in the Frobisher area, and broods of 8, 7, 6, 1 young in Penny Highland, two of them near Base Camp.

13. RINGED and SEMIPALMATED PLOVER *Charadrius hiaticula* Linnaeus. Few seen and in none was the subspecies identified. Two flocks of 12 and 7 at the head of Padle Fjord on June 3. In Owl Valley one was at a high pond 20 miles inland on June 18. Wynne-Edwards heard one on the tidal reef at Pangnirtung on August 22 and saw another near the river mouth there.

14. TURNSTONE *Arenaria interpres* (Linnaeus) Three at the Padle estuary on June 3 and a fourth with a party of plovers. One seen by Schwarzenbach on the gravelly sands by Tundra Lake, Padle Valley, July 25. There were only two in Hantzsch's collection (Hesse, 1915) and none was seen by Kumlien, or by Soper who concluded that it was extremely rare on Baffin Island. Since then, Manning (in Bray, 1943) has recorded them as nesting quite commonly at Taverner Bay on the Foxe Basin coast.

15. PURPLE SANDPIPER *Erolia maritima* (Brünnich). Two seen by Wynne-Edwards among rock pools, Milliakdjuin Island, Cumberland Sound, on August 5.

16. WHITE-RUMPED SANDPIPER *Erolia fuscicollis* (Vieillot). An adult and juvenile on beach at Pangnirtung, September 1.

17. BAIRD'S SANDPIPER *Erolia bairdii* (Coues). Found in Owl Valley in small numbers wherever there was suitable habitat of wet marshy ground and small ponds, from the estuary to 250 m and 20 miles inland. First seen June 11, by June 13 several had arrived already in pairs. The plumage varied greatly, some being prominently spotted on the breast while at least two had scarcely any spots. The ground color also varied; one was extremely light gray-buff with an even lighter head and another had a marked pied pattern on the back. The trilling note, heard only twice by Wynne-Edwards at Clyde, was heard several times from a newly flushed bird and also when they were flying around anxiously and were suspected to have eggs or young; it is somewhat similar to the trill of the Dunlin *Erolia alpina* in Europe. One was in distraction display, July 16, on shingle flats of Owl River delta, but neither eggs nor young could be found.

18. NORTHERN PHALAROPE *Lobipes lobatus* (Linnaeus). Two phalaropes (sp. ?) near Durban Island, May 28. In one small area of marshy ponds in Owl Valley at about 150 m a small group of 12 Northern Phalaropes was found on July 14. Only three certain females were seen together. Breeding was suspected from the behavior of several of these males, but no eggs or young were found. Many flocks of up to 100 phalaropes (sp. ?) were seen in Cumberland Sound off Milliakdjuin Island - Cape Mercy, September 7.

19. GLAUCOUS GULL *Larus hyperboreus* Gunnerus. The first gulls, a group of about four with light wing tips, seen from the plane over a small patch of open water in Cumberland Sound on May 13, could not be identified. Two Glaucous Gulls passed north on May 15 up South Pangnirtung Fjord, then completely frozen over. On May 22, 20-30 were on the great cliff east of the weather station on Padloping Island, the site of a colony of about 50 pairs found by Wynne-Edwards in August 1950. There was another small group on low cliffs at the north end of the island, and at Cape Searle 50 were seen on May 23 at the beginning of the cliffs on the south side where Wynne-Edwards had found 20 pairs in 1950. On May 25, three were sitting on nests which then contained no eggs, but they were probably just about to lay, as five were sitting hard on May 27. A male specimen taken there on May 23, which had a left testis measuring 20.5 × 10.5 mm and the right testis almost as large, was probably in breeding condition (Marshall, 1952, for comparison details). Its stomach was empty. On May 29 Thompson found a gull nest with two eggs, probably of this species, near the top of South Pangnirtung Fjord. In Padle Fjord small numbers were wandering about, some up to 20 miles from the nearest water, salt or fresh. None was seen eating, but a male specimen from here on June 2 had a small *Dicrostonyx* lemming in its stomach; its testes measured 22.5 × 12.0 mm, 17.0 × 11.5 mm, probably also in breeding condition. There was a small colony near there, of 40 birds on a south-facing cliff, some sitting on nests on June 3; the cliffs, of gneiss or granite, were covered with the orange *Caloplaca* lichen as at Cape Searle. Several nests with fresh eggs were found on June 4 by Samo on the flat sandbanks of the Padle River delta. In mid-June numbers varying from 8 to 16 stayed on the Owl River sand

flats near Bio. Camp. These were all nonbreeding adults, and they remained for the whole summer. Several times they were watched feeding on small Arctic Char *Salvelinus alpinus* on the river. Many times these gulls were extremely inquisitive and would often move up from the river as soon as one came within half a mile, and follow close overhead sometimes up to half a mile or more, calling loudly and occasionally diving. A few nonbreeding birds stayed on the lakes around Base Camp and June Valley, and Schwarzenbach saw them on Lakes in Naksakjua Valley up to 600 m where there were still shoals of small fish. Ward found a pair, August 13, with two fully-grown young on a small flat islet of sand and stones on Coronation Fjord below the snout of Coronation Glacier. The nest was completely exposed on the bare sand. There was a small colony on the cliffs opposite the settlement at Pangnirtung; Wynne-Edwards saw many still on the ledges with their young there on August 15, and by September 3 the young were fledged.

20. KITTIWAKE *Rissa tridactyla* (Linnaeus). Many in outer Cumberland Sound, September 7.

21. SABINE'S GULL *Xema sabini* (Sabine). One lying dead on a sand bank of Owl River nea Bio. Camp, June 18.

22. BRÜNNICH'S MURRE *Uria lomvia* (Linnaeus). None seen during the sledge trip on open waters near Durban Island or off Cape Searle in late May. Normally they return to the breeding areas in high-arctic Greenland in mid-May (Salomonsen, 1951), and it seems likely that they were late in 1953 because of the heavy ice cover on the sea. Immense numbers were seen in these waters by Wynne-Edwards in 1950 and by Ellis in 1953. Ellis informed me that in August, which was a slack time for seals, the Padloping Eskimos depended to a considerable extent on the murres for food. The colony is near Padloping at Reid Bay; Kumlien's (1879) report of a large colony in Exeter Sound was also confirmed by Eskimos in 1953.

23. BLACK GUILLEMOT *Cepphus grylle* (Linnaeus). None had returned on May 22 to the colony of about 100 pairs found by Wynne-Edwards (1952b) several miles northeast of the Padloping Station, and there were none at Cape Searle. They were probably late because of the extensive ice cover on the sea. At the arctic Greenland colonies they return in late April and the first half of May (Salomonsen, 1951). An old skeleton with wing feathers intact was found below the towers of Cape Searle, May 24. The wing measures 159 mm and resembles the *C. g. mandtii* type, though with a lack of white on a few of the secondaries that indicates an intermediate status between it and *atlantis* (see Wynne-Edwards, 1952b).

24. SNOWY OWL *Nyctea scandiaca* (Linnaeus). The observations on breeding Snowy Owls will be published separately. These were the only common predators, feeding almost exclusively on the very abundant lemmings.

25. HORNED LARK *Eremophila alpestris* (Linnaeus). Common only on the dry well-drained ground such as sand flats and the banks of the river and estuary, up to 250 m. Smaller numbers bred in other habitat, on the dry stony hillsides up to 600 m, occasionally seen to 750 m, and in the low wet heath in the best area for longspurs.

The first seen was a male singing at the Padloping Station on May 31. Several males and one pair were at the head of Padle Fjord on June 3. They became fairly numerous in Owl Valley where the majority arrived about the middle of June. Song flights were frequent in the latter half of June, and they also regularly sang from the ground. Song output decreased greatly after the end of June.

I confirmed the observations of Soper (1928, 1946) in south Baffin and Wynne-Edwards (1952b) at Clyde, that the amount of yellowing on the face and throat of these birds varied considerably in the same small area. There was a gradation from birds with bright yellow face throat and eyebrow typical of *alpestris*, through a range of intermediate forms to some typical of *hoyti*, with white face and eyebrow and very faint, or in one individual no trace of yellow on the throat. Of 33 adults seen close in good light, 9 were recorded as bright or very yellow on face and throat, 9 as pale yellow and 15 as very pale with the yellow on the face in very faint traces or else completely absent. Wynne-Edwards and Soper also found a predominance of pale types at Clyde Inlet and Nettilling Lake. South of the line Nettilling Lake - Penny Highland there must be a marked transition zone, as at Frobisher Bay only 200 miles south, pale-faced individuals are evidently outnumbered 7-10:1 and most birds are typical *alpestris* (Sutton and Parmelee, 1955a). In northern Ungava and Labrador only *alpestris* breeds (Manning, 1949) and already on the west coast of Baffin around Taverner Bay, 150 miles north of Nettilling Lake, the breeding birds are typical *hoyti* (Bray, 1943). The existence in this species and in the Black Guillemot of hybrid swarms occupying the zones of overlap was postulated by Wynne-Edwards (1952b).

Though latest in arriving, the larks nested as early as the other passerines. A nest was found on June 13 on the exposed top of the river bank of Owl River at 250 m, 20 miles inland; lined with hare down and ptarmigan feathers, it contained five eggs. The call of the anxious female was a loud 'tshee-tshee-tshee.' The female was sitting hard on June 18, and ran off, crouched low, with spread wings. During the next two days there were snowfalls, and on June 20 the nest was found deserted; the eggs, containing embryos of widely differing development up to one almost ready to hatch, were cold. Two more nests, lined with lemming hair and containing five eggs each, were often visited in the favorite longspur habitat of wet heath. In one, four young had hatched about July 5 and one egg remained in the nest till after the four young left. None of these nests had been used in a previous year. Another brood of at least three young fledged near Bio. Camp, and they were already full grown and separate from the parents on July 14. Several fledged broods were seen in mid-July, and a few at 250 m newly fledged in the last week. One brood on July 29 had tails just visible and were unable to fly more than five yards at a time. Most left in late July and early August, and only one was seen in Owl Valley, August 16-20.

A female specimen in Owl Valley on June 27 has a pale yellow face. Measurements: ovary 7.0 × 5.6 mm, largest oocyte diameter 2.6 mm, wing 102 mm, culmen 12.0 mm.

26. RAVEN *Corvus corax* Linnaeus. Several at the dump at Frobisher Airbase on May 13, and up to six together at Pangnirtung in mid-May. At least two pairs, Cape Searle Island; here on May 23 at the top of the mountain one was watched in display flight, turning over on its back in mid-air and uttering a note like a cork being drawn from a bottle. Several at Padloping settlement, and frequently seen in Owl Valley, usually in parties of two or three. A large old nest of *Salix* sticks, probably of a Raven, was found on September 3 on a ledge of a small low cliff opposite Pangnirtung. A few times Schwarzenbach and I found Ravens intensely curious on the flats of Owl Valley; they flew close following us, or hopped in front, croaking excitedly, for quite long distances.

27. GREENLAND WHEATEAR *Oenanthe oenanthe leucorhoa* (Gmelin). We found none nesting in the interior of Cumberland Peninsula, so confirming the conclusion of Soper (1928, 1946) that it was one of the rarest birds in this area. He observed it only at autumn migration time when several were at South Pangnirtung Fjord. Shortt and Peters (1942) saw an immature bird at Pangnirtung. Wynne-Edwards (1952b) found it one of the commonest breeding birds at the head of Clyde Inlet; he also recorded breeding at Frobisher Bay, and it was common and breeding there in 1953 (Sutton and Parmelee, 1954c).

The majority of those seen by the 1953 expedition were migrants. Three males and a female together at the top of Cape Searle Island on May 25 had gone next day, and another was near Durban Island on May 29. From then till autumn migration time only one was seen, a male at 500 m on a hilltop north of June Valley on July 3. On August 8 three males stopped for a few hours in a sheltered place at Base Camp before flying on south down the Pass. One was watched hovering for three seconds at a time as it caught mosquitoes in mid-air; it was heard calling a single low 'tshik.' Another was seen by Schwarzenbach in the southern part of the Pass on August 3, and two more there on August 28.

They bred at Pangnirtung in 1953, found by Wynne-Edwards. On August 15 he saw an adult and a fledgling still with down on its head, below the gull cliff opposite the settlement, five at the settlement on August 18, an adult gathering food near there on the 19th and a fledgling on the 20th.

28. WATER PIPIT *Anthus spinoletta rubescens* (Tunstall). Pipits were common both on the coast and inland. They were most abundant on dry slopes with heath vegetation, and where there was a lack of boulders in this habitat they became the commonest bird, associating with the less numerous redpolls. They were also common on gently sloping drained grassland and on the lowland flat ground by the banks of Owl River and the head of Padle Fjord; apparently they are not usually found on flat ground (Wynne-Edwards, 1952b, Sutton and Parmelee, 1954b). They bred at least to 650 m on patches of high alpine grassland at the head of June River, and in the poorly vegetated ground at the top of Pangnirtung Pass at 450 m.

The first seen was a male on one of the islands south of Padloping, May 28; its song flights were as great as 150 feet of a vertical drop. One was singing at Padloping on May 31, and the first arrived at Base Camp on June 2. Several males were singing along Padle Fjord, and by June 4-5 in June Valley they were common and many females had arrived. Within a few days the earliest birds were nesting. One was watched carrying grass in its bill on June 8 at 400 m in June Valley, on the only snow-free patch on the whole hillside.

Song decreased markedly after the beginning of July. One was heard singing a few of the opening notes on July 15 and the latest one in two full song flights on July 16. A nest with six eggs was found near Bio. Camp on June 25 on a sheltered south-facing bank, with a lining entirely of fine grass leaves. The main body of the nest was of coarser-sized grass leaves; within it there was a very distinct old lining of fine grasses dirty-gray in color, below and around the 1953 lining of fresh straw-colored grasses. The two linings (which were also seen at various dates by B. Bonnlander, J. A. Thomson, H. R. Thompson, F. Schwarzenbach and H. R. Weber) are clearly visible on a color photograph taken at a range of four feet. The linings were easily separable. There was no question of the nest's being used for a second brood; by July 4 all the eggs had hatched and the six young, with well-grown tails, were almost ready to leave on July 11.

Two other nests were found, and one of these had also been used in some previous year. The second nest, found by H. R. Weber among *Cassiope tetragona* and *Vaccinium uliginosum* in a recess between boulders, also had two very distinct linings of fine grass, and contained five large young on July 9. The third nest, found near Base Camp after the young had flown, contained feather-sheath particles and one egg trampled through the lining into the body of the nest. The lining was again of fine grass leaves, but there was no trace of any old lining.

The adaptation of adding a fresh lining to a nest used before, which clearly saves time in the brief arctic summer, was discovered by Wynne-Edwards (1952b) at Clyde in north Baffin Island in redpoll and wheatear nests and possibly also in one longspur nest. It was not recorded by him in six pipit nests. There was no mention of finding any relining of nests in a total of 14 pipit nests in 1953 at Frobisher Bay (Sutton and Parmelee, 1954b).

After July 16 many broods of fledged young appeared, the first at North Pangnirtung Fjord. Most of the young there on July 16-17 had tails about half-grown or less, though one brood still being fed by a parent had fully-grown tails. Fledged broods, being fed entirely on insects, were very common around Bio. Camp on July 19 and 20. At Base Camp a pair reared a brood which had ¾-grown tails on August 2. Many family parties were seen on August 4, when young were still being fed though they nearly all had full-grown tails. After this time, large numbers were frequently seen flying south down the Pass in small flocks, and there were few left in Owl and June valleys from August 16 to 21. Scarce at Pangnirtung on August 4, they were seen in flocks on August 19 by Wynne-Edwards and there were still small numbers there in early September.

The extent of spotting in the plumage varied greatly; some males had no spots on breast or belly. Recent study of this question is discussed by Sutton and Parmelee (1954b).

29 and 30. REDPOLLS *Acanthis hornemanni* and *A. flammea.* Many were seen in 1953, though previous records suggested that redpolls were uncommon in summer in the Cumberland area. Soper (1928) had seen and obtained individuals of both species around Pangnirtung and Blacklead Island in autumn and winter only. Hantzsch (see Hesse, 1915) saw redpolls in early summer at the head of Cumberland Sound, and one specimen is *flammea* and very likely *flammea rostrata* (Salomonsen, 1951); he also saw redpolls in autumn on Foxe Basin. None were found in the Foxe Peninsula - Lake Harbour area by Soper (1946) who noted then of *hornemanni* that it occurred apparently only as an irregular migrant on Baffin Island, and in 1950 the first nests, six of *hornemanni* and two of *flammea*, were found within the same area at Clyde by Wynne-Edwards (1952b).

Though Salomonsen's opinion (1951) is that *hornemanni* is merely a mutant of *flammea* with selective value in high-arctic conditions, Wynne-Edwards (1952b) decided that the two forms could be regarded only as distinct species in Arctic America. The same conclusion was reached in Lapland by Løppenthin (in Lundevall, 1952) who drew an analogy to this case in the Common and Arctic Terns.

In Penny Highland also, both were found in the same habitat. Baffin Island lies in the zone of overlap and there may be a tendency for ecological divergence at the extremes of the range. The subarctic birch forests contain *flammea* exclusively, and though it extends far north of the tree line within the range of *hornemanni* it may be absent or only rarely seen at the extreme north limits of *hornemanni*, such as in all of north and northeast Greenland (Salomonsen, 1951); most expeditions to parts of far-north Siberia, and the Canadian polar islands (Pleske, 1928; Gladkov, 1941; Godfrey, 1953; Macdonald, 1954) and others, appear to have seen *hornemanni* only. An altitudinal divergence has also been noticed (Lundevall, 1952) in the Lapland mountains, with only *flammea* in the mature birch woods and only *hornemanni* on the high mountain tundra. But this may not be universal; both species had nests on the mountain tundra in another part of Swedish Lapland (Swanberg, 1951), and in Norwegian Lapland in 1955 I also found both breeding in this habitat. In Cumberland there was no evidence of any altitudinal divergence, and in fact those seen highest in the mountains were all *flammea*.

Difficulty in distinguishing the two species in the field has not been usual to most observers, and I also found this in Baffin and in Norwegian Lapland.

The amount of red on the breast of the male *flammea* varied greatly and there was a continuous range from some with almost pure white breasts to others with the whole breast and throat a brilliant rosy color. Two males with white breasts had as large testes as two others with red breasts, also found by Salomonsen (1951) and Brinck and Wingstrand (1950-51). Of 29 male *flammea* that I saw close 13 were noted pale- or white-breasted and 16 pink or red. In *hornemanni* pale-breasted males probably predominate, and only 4 out of 15 in Cumberland had any trace of pink.

The brilliance of the red on the cap and rump also varies. One dark female *flammea* with a young fledgling had a cap noted as pale buff-brown, and might have passed as a juvenile in poorer light. Again, one very small and dark male shot on June 29 might have passed as a female in the field had it been alone; there was no trace of red on its dark throat and breast and only a small patch of dull orange on its cap. Consequently great care is needed in deciding the sex of these redpolls in the field.

Redpolls were most common, and bred, in two habitats, the closed dry heath and the ancient lateral moraines. Both sites were well-drained and heathy with *Salix* spp., *Empetrum* and *Ledum* dominant, and in June Valley also *Betula glandulosa* in scrub to two feet high. The old lateral moraines afford a very favorable microclimate; vegetation was generally richer there, including such plants as *Taraxacum*, and insect life more abundant. They usually gave considerable shelter and even on cold windy days butterflies and mosquitoes were often still active there. Redpolls were also frequently seen near an old ground moraine almost devoid of vegetation; large flocks gathered there in August and along the old lateral moraines in Weasel Valley. They were rarely seen above 400 m even in the rich June Valley; most were below 250 m and the highest was a single bird at 550 m.

The great majority were *flammea*; of 160 whose identity was fairly certain, only 25 were *hornemanni*, of which 9 at Cape Searle in late May were probably migrants. Of a total of 150 seen after mid-August when movement became general there were only 7 *hornemanni*. Both species were common at Clyde in 1950, but the numerical proportions in which they occur at Churchill vary from year to year (Grinnell, 1943).

The first seen were a male and two female *hornemanni* on the beach at Cape Searle on May 23, and next day six more males were on the steep grass slope below the Fulmar cliffs. These were presumed to be migrants as they were not seen again. *Flammea* had arrived by May 27 near Durban Island, where up to 12-15 with three *hornemanni* were on a snowfree strip near the shore; they were probably also migrants, and next day six were watched flying away over the ice towards the north. In Owl Valley they were present in small numbers, from the estuary up to Base Camp, throughout the summer; only five *hornemanni* were noted. In June Valley there were no *hornemanni* in 25 redpolls in July, and only one was seen by Schwarzenbach in Naksakjua Valley. A juvenile at Quickstep Harbor, Cumberland Sound, on August 10, and several near Pangnirtung on August 15 were all *flammea*, seen by Wynne-Edwards. Flocks totaling over 70, including only one *hornemanni*, appeared at Bio. Camp on the way south along the Pass on August 15, and from August 27 to 29 many flocks of up to 20, all *flammea*, were seen along Weasel Valley, where Wynne-Edwards had earlier seen 20 *flammea* and 6 *hornemanni* on August 24. There were several *flammea* below the gull cliff opposite Pangnirtung, September 3. A male *hornemanni* on May 24 at Cape Searle had a wing length of 82 m. Four male *flammea* had wings 79, 80, 80, 82 and one female 81 mm.

In June Valley a nest of *flammea* was found on July 3 in the zone of rich heath marked by dwarf birch scrub *Betula glandulosa*. It was built in a clump of birch growing from the top of a stone and was altogether two feet above the ground. Five nestlings burst out and one remained. The one that stayed could barely flutter more than a yard when taken from the nest, and tail feathers only one centimeter long, while at least one of the others had a fully-grown tail and flew straight out for 200 yards. This range in development, greater than in any brood seen in the whole summer, clearly reflected the spread in hatching and the long incubation from the first egg that were observed in the longspurs and Snow Buntings, (and also noted in redpolls at Clyde by Wynne-Edwards). The nest, partly flattened by the large brood, was lined with the seed wool of *Dryas integrifolia* and a ptarmigan feather. Three distinct linings were separated under the 1953 lining, showing that the nest had been used four times. Every one of eight redpoll nests at Clyde had been used before (Wynne-Edwards, 1952b) and a description of a nest taken near the Mackenzie delta suggests it had at least two separate linings (Schaanning, 1933). The older linings in the June Valley nest were almost entirely of *Dryas* seed wool, easily confused with *Salix* seed wool; one also had two ptarmigan feathers. The main body of the nest looked very old; a sample was composed of shoots of *Poa arctica*, all old and fungus-infected. The first egg must have been laid about the second week of June at the latest, when the valley was still covered with deep snow and certainly less than 10 percent of the ground was bare even on this south-facing strip that was first to clear. Schwarzenbach pointed out that *Dryas integrifolia* grows typically on exposed situations likely to be early clear of snow.

On July 3 another juvenile *flammea* in June Valley was fully grown and separate from the adults. Two young just able to fly were with a female in Owl Valley on July 14, and two more broods being fed, one by a female and one by both parents, near the estuary from July 15 to 17. Typical call of the young is a harsh 'tshaw tshaw.' There were 8-10 more juveniles separate from the parents, except for one full-grown bird being fed occasionally, near the estuary on July 16.

The only breeding *hornemanni* found was a female on July 28 with a short-tailed young unable to fly more than 20 yards at a time, on the stony hillside near Bio. Camp. The spread in redpoll fledging had thus occupied at least a month.

Though song and display of Snow Buntings and longspurs had virtually ceased in the first week of July, many redpolls were still in full song then. More remarkable was to find intense sexual activity as late as July 16 on a sheltered slope above North Pangnirtung Fjord where over 30 *flammea* redpolls were gathered in a small area of rich *Salix* heath. At 19.00 the sun shone warmly and where seven males had collected in an area of about 10 square yards there was a sudden burst of activity with much excited calling and movement, including threat postures and loud song from several males. Once a male displayed, running crouched, with tail fanned, along a boulder in front of a female. The testes of this male were still at maximum size; longspur and Snow Bunting testes were already extremely small by July 11.

A resumption of display, song and even pairing was noticed at one sheltered locality in west Greenland by Salomonsen (1951) who suspected from this and other evidence that double brooding may occur. Near west Hudson Bay a male *hornemanni* had full-sized testes on July 16 (Harper, 1953). The size of gonads in July in Cumberland suggests that two clutches may possibly be laid there also in a favorable summer.

Body molt had started in the male *flammea* specimen from July 16, which had some dark pigmented follicles on the chin and more on the crown, though there were no external signs of molt. The female on July 16 had not even internal signs of body molt.

31. LAPLAND LONGSPUR *Calcarius lapponicus* (Linnaeus). The commonest bird in the floor of the great mountain valleys. Peak density was reached wherever the ground became slightly drier and more heathy with a good growth of *Salix* spp., though with close access to wetter areas. In this habitat Snow Buntings were generally rare or absent, though becoming numerous as soon as there were any boulders. On drier ground where the heath became closed, longspurs were more uncommon, outnumbered by redpoll and pipit, and they were also scarcer on the heathy and rocky outer coast. They were abundant to 250 m in Owl Valley and 350 m in June Valley. In Owl Valley they were breeding up to 300 m on west- and north-facing slopes; east-facing slopes were drier and more heathy and so held fewer. In June Valley they were breeding up to 400 m on one south-facing slope, and Schwarzenbach found a young bird just able to flutter at 500 m in the rich Nak-

sakjua Valley in July. Several unmated males were seen in poorer habitat at 400 m around Base Camp, and up to 600 m on the June River pass. Schwarzenbach saw one juvenile at 920 m in another pass looking for food in late July.

Display was watched on June 14 when a male walked slowly away from a female and crouched, spreading and raising the wings slightly, and fanning and lowering the tail to show the prominent white on the tail feathers. A crouching posture with slightly spread wings was also adopted by males threatening other males and other species. After threat posture a male, calling a loud chattering note, was seen to drive away a pair of Snow Buntings which had just arrived on a nearby stone; it flew first at the female bunting which was the nearer of the two. Two mated females were fighting fiercely another day, without participation by either male. Distraction display and displacement feeding were seen in females disturbed from the nest; a low screeching note was heard during distraction display.

The first seen was a party of four males on the Cape Searle beach on May 22, and next day over 40 had arrived with equal numbers of males and females. Clearly these were all migrants as most of them had gone by May 25 leaving only a small number, some right up to the stony crest of the island at 400 m. First song was noted on May 28 near Durban Island and the first song flight June 2. Song suddenly became general on the first warm sunny day on June 3, thereafter reaching a peak. There was much singing till the last week of June, after which it ceased abruptly; none were heard after the first week of July.

Song was generally at a peak in the early morning from 03.30 to 06.00 (all times are solar). On some clear and sunny nights as on June 17 and 24, they were active and singing till 20.40 and a few till 22.00, and had started again at 01.10. On two cold and cloudy nights in mid-June with occasional snow flurries, there was no song or activity of any kind after 20.30 and several pairs were found roosting together in grass tussocks at 20.40-21.00. In northern Alaska they seemed less active at night than other birds (Brooks, 1915) and Dixon (1943) noticed that in June singing ceased about 22.30 and they roosted till 02.30. The amount of general activity is influenced not only by climatic conditions but also by the date and the intensity of territorial activity of the males. Migrating longspurs at Cape Searle were also roosting by 22.00 in late May. On the other hand many in June Valley in early June did not roost at all for two whole nights, and song went on almost continuously throughout the night, though the skies were gray and snow fell steadily in windless and foggy air. Probably the very great concentrations of birds on the small areas that were snowfree had stimulated more activity than usual.

Nineteen nests were found, the highest at 300 m. They were usually well hidden in a tussock of grass or *Salix*. Of four examined by Schwarzenbach three were built of *Carex rigida* and one of *Arctagrostis*. Usually there were several ptarmigan feathers in the lining, sometimes hare down, lemming hair, and *Salix* seed wool. One nest found on June 29 had been used in a previous year; it contained two very distinct linings. Another had probably been used before, but none of the other 17 had been relined. At Clyde in 1950 Wynne-Edwards saw one longspur nest that might have been used before, and he suspected that this species might share the adaptation of relining of old nests that he found there in redpolls and wheatears. None of 22 nests at Frobisher Bay in 1953 had been used before (Sutton and Parmelee, 1955b). Certainly the climate of Penny Highland is more severe than at Frobisher, and relining may be more usual in the far north.

Egg color varied greatly; the general ground color was either gray-brown or blue-white, but one set had a dark olive ground color, another sky blue, another white. In one clutch of six, one egg was white, devoid of the usual purplish markings. In 13 clutches known to be complete, the mean size was 5.5, the range from 4 to 7 eggs (2 with 4; 5 with 5; 4 with 6; 2 with 7). Though a few of the eggs that did not hatch disappeared, most remained in the nest; in three nests with clutches of 6, 7 and 6, the 2,2 and 4 eggs which failed to hatch remained in the nest till after the young had gone. During the incubation period one egg disappeared from each of two nests.

Egg-laying time was spread over 3½ weeks, without the possibility of second broods. The earliest nest had cracking eggs on June 24; the latest newly hatched chicks on July 19. Nevertheless there was a definite peak in egg laying in the last week of June, resulting in a peak of newly fledged young in the third week of July.

The male was never seen sitting on eggs or young. Incubation periods for the last eggs laid in two nests were almost exactly 11, and

12-13 days. At two nests the females certainly began to incubate from the laying of the first egg, and early incubation was suspected in most others, though in a few it definitely did not occur. At one nest the eggs were cold on many visits during the first two days of laying, though warm after the third day. At another the female was not sitting for at least the whole of the two afternoons on the dates of laying the first two eggs; here three young all hatched the same day followed by the fourth early the next day. A much greater spread in hatching resulted from the early incubation at most nests. At one where all five eggs hatched, hatching occupied at least three full days, and about three days at another where five hatched out of seven. Hatching at Clyde lasted for 2-4 days (Wynne-Edwards, 1952b); from one to at least two days were recorded by Bertelsen (1928), Sutton and Parmelee (1955b). Nestlings in Cumberland broods all showed a marked gradation in size, at some nests so great as to suggest even longer spreads in hatching. In Siberian Yamal, Dunaeva and Kucheruk (1941) stated that the young of passerines differ considerably in weight from the first day, though hatching lasted not more than one day; however the two examples they presented suggest that at these two nests it occupied at least one and possibly more days.

I confirmed that the young leave the nest when they are about 8-10 days old and unable to fly (Bertelsen, 1928; Mikheiv, 1939; Wynne-Edwards, 1952b). The gradation in development was still evident in the broods at fledging time. All the individuals of a brood rarely left the nest together. Unlike some Snow Buntings the oldest young did not return again to the nest after leaving it for the first time. In at least four nests the smallest individual was left behind in the nest and was no longer fed, apparently deserted, till up to a day after the others had gone. Two such young died, one in the nest and one outside. Another which fluttered from the nest after most of a day alone had all tail feathers and primaries entirely in sheath, with not even the tips of these feathers showing; it was then not more than 7 days old. Most left at 8 or 9 days, when these feathers were just beginning to appear. The first tail and primary feathers appeared at Churchill on the eighth day (Grinnell, 1944). Only four out of 16 left at 10 days or over. About the third week of July most young being fed by adults were unable to flutter more than a few yards and their tails scarcely showed. Many seemed to have been deserted and dead ones were often found; a few that I examined had large tracts of bare skin and a tail with feather sheath and tip combined not more than 5 mm long.

Table 4 records the breeding success of Lapland Longspurs.

TABLE 4. BREEDING SUCCESS OF LAPLAND LONGSPURS

CLUTCH SIZE	NUMBER HATCHED	NUMBER LEFT VICINITY OF NEST
6	2	2
5	5	4
6	5	At least 3, probably 4
5	5	2
4	0	0
7	4	4
7	5	Not known
5	4	4
Total 45	30	>20

Sixty-seven percent of the eggs hatched and this percentage of the hatched young left the vicinity of the nest. Hatching was possibly more successful at Frobisher in 1953, with a 77 percent hatching rate from 97 eggs (Sutton and Parmelee, 1955b).

All the passerines fed their young to a large extent on the same flying *Diptera*, mostly mosquitoes (largely female *Aedes*), chironomids, some *Tipula* and *Sciara* and others, a food supply extremely abundant on the tundra in July. The greatest density of *Diptera*, especially mosquitoes, was from the first week of July to July 26, reaching a peak from July 18 to 21. The main appearance of young birds just out of the nest happened to coincide with this peak in food.

The period of insect abundance was interrupted by the cold spell from July 15 to 16 when northerly winds brought 6-12 inches of snow down to 300 m and prolonged wet snow and sleet at sea level. Apart from a small number of chironomids in sheltered places, flying *Diptera* disappeared. Cold not only immobilized the adults and made them harder to find in the vegetation, but probably also reduced the numbers emerging from larvae. In mid-August the mosquito season was ended in a single day by another spell only slightly colder, when snow lay almost to sea level. The July cold spell coincided with the first main rush of longspurs and Snow Buntings leaving the nest. The adults, which were usually seen catching great numbers of insects by snapping at them in the air, had to search for food in the vegetation. During the following week many young longspurs were found dead on the tundra, nearly all at an undeveloped stage. Had it not been for the very warm weather and peak mosquito abundance that followed the cold spell, mortality would undoubtedly have been greater. Though many died in the nest most of the mortality affected young just out of the nest. Six of these were found dead on the ground in an area in which 11 pairs had bred, and six in a more closely watched area in which only five pairs had bred. In late July broods were of only one to three young—1, 1, 2, 2, 3 noted—and many probably lost their broods. Many young Snow Buntings also died. The young that died in or near the nest were usually the smallest, least developed in feathering, and probably least able to withstand exposure when food became short. During summer cold in Siberian Yamal when there was considerable mortality among young Lapland Longspurs and and other Eurasian tundra passerines it was always the smallest that died, unable to get enough food in the face of the larger nestlings' competition (Dunaeva and Kucheruk, 1941). Pipits, redpolls and larks seemed to have been less affected. There were many fledged broods, especially of redpolls, before the storm came, and only one dead young pipit was found. Nevertheless it was impossible to be sure to what extent they had suffered, as they were uncommon compared with the buntings and longspurs, and the fate of a sufficient number of nests could not be followed.

A few days after the short warm spell that followed the storm, a more prolonged period of damp cloudy weather lasted from July 26 onwards. Temperatures were not so low (fresh snow line at 1400--1800 m) but there was heavy cold rain and persistent wet fog. Flying insects became much scarcer. The young were probably still more liable to be affected by the wet and cold than adults, and many young longspurs were seen sheltering under banks and stones. However by this time nearly all were well-developed, already feeding to a large extent on vegetable food, and no more dead were found. Most adult arctic passerines can live on vegetation, and at least in such a hardy species as the Snow Bunting it seems likely that the most frequent causes of mortality in the arctic summer are such cold spells affecting the young at a crucial time when they are still dependent on insect food.

At Frobisher Bay where the same cold spell, though not so low in temperature, lasted longer and strong winds were frequent, heavy mortality resulted and many young Horned Larks and whole broods of pipits perished in the nest (Sutton and Parmelee, 1954b). Lapland Longspurs and Snow Buntings apparently suffered little in comparison (*same*, 1954a, 1955b) though breeding success of the buntings was probably as low as in Owl Valley.

These results contrast markedly with the very high success found at Clyde in 1950 (Wynne-Edwards, 1952b), when all of 29 longspur eggs hatched and there were very few natural nestling deaths. Certainly the records show that June 1950 at Clyde was much warmer and finer than June 1953 in Penny Highland, and there was also no cold spell in July 1950. Hatching success is probably lower than usual in a wintry June, or else greater than usual in a fine June.

My experience differed from the conclusion of Gladkov (1941) and Sutton and Parmelee (1955b) that the adults leave the young and live singly during the molt; between July 19 and August 2 Sutton and Parmelee noted no pairs or family groups and 'always separate birds' (p. 123). Though some young just out of the nest in Owl Valley seemed to have been deserted, and most adults were solitary, we saw many groups of young, especially with adult females, during this period, even till the end of July. In one family party at Bio. Camp the three young stayed with the female for two weeks after leaving the nest. Though they were already eating mosquitoes when only 12 days old on July 18 most of the feeding was done by the female; the young could not then fly more than five yards. Growth was rapid, and by July 22 their tails were 2/3-grown, on July 25 almost fully-grown, but the female fed the young regularly, once as early as 01.40. The young, with full-grown tails, were still being fed on July 27; on that date one of the young was on its own for the first time and allowed approach to within three feet. It was watched feeding for the first time on vegetation, on the red seed heads of *Salix*. Young in the nest and able to fly appeared to be fed entirely on insects, at Bio. Camp largely on female mosquitoes. Sometimes very large insects were brought such as *Tipula arctica* and large *Lepidoptera.*

A male had begun body molt on July 11, without external sign of molting, and on July 15 another male was molting on both sides of the neck. By the end of July most males appeared in heavy molt, especially on the head. Most in the first half of August had no trace of a tail and few primaries and could flutter weakly only a few yards. By July 28 most of the Owl Valley population had gone, and none were seen from August 17 to 22 except two parties of about 10 each flying strongly south down the Pass; all these had fully-grown wing and tail feathers. Few were left at Pangnirtung in early September.

Table 5 records measurements of male Lapland Longspurs.

TABLE 5. MEASUREMENTS OF MALE LAPLAND LONGSPURS

DATE	LOCALITY	WING (MM)	CULMEN (MM)
May 26	Cape Searle	97	12.1
June 27	Owl Valley	96	12.1
June 29	"	96	11.5
June 29	"	97	11.8
July 11	"	93	12.4
July 11	"	92	11.7
		Mean 95 mm	Mean 11.9 mm

The writer is in agreement with Sutton and Parmelee (1955b) that birds from southeast Baffin Island should probably be referred to the race *C. l. lapponicus.* Culmen and wing lengths of three males from Frobisher are very similar to those of the six Cumberland males. The wing measurements of these males are similar to those of three Clyde males (Wynne-Edwards, 1952b) and to series farther west (Hørring, 1937); culmen lengths of the Clyde birds, measured by the writer, are 11.6, 12.1, 12.6 mm. Salomonsen (1951) has separated a large-billed Greenland race *C. l. calcaratus* with mean culmen 14.54 mm in 57 males, and decided that the North American ones were nearest this race; in fact Canadian arctic birds seem nearer the typical race.

32. SNOW BUNTING *Plectrophenax nivalis* (Linnaeus). The commonest bird in the interior, as well as on the coast and outer islands. It was abundant in wet and dry situations wherever scattered boulders afforded nest sites. Where there were few or no boulders and cliffs, the density was very low, and in large areas of grass flats at the head of fjords and in the closed rich heath none were breeding. Occasional unmated males were seen in these areas, and there were small numbers even on sandbanks and dunes devoid of boulders; at least one pair nested successfully in a tunnel in a sandbank. In Bear Island they were also absent from a large area of suitable feeding ground devoid of nest sites (Bertram and Lack, 1933). In Cumberland they were frequent to 600 m and small numbers bred to 800 m. Occasional birds were seen up to barren screes at 1000 m, usually unmated males feeding on *Diptera.* There were even occasional males and small male groups on the Penny Ice Cap at 1800-2000 m at the end of May to early June. The highest female seen was at 1050 m.

Several singing males were already at Frobisher on our arrival on May 13 and one male at Pangnirtung next day. Many more males arrived on May 15 and singing and territorial behavior became general. Only one silent male was at Padloping Island on May 19 when the snow cover there was unbroken. There were a few at Cape Searle Island on May 22 and next day large numbers had arrived, including the first females. The males occupied territories and paired with the females though they were clearly migrants; nearly all had gone by May 25. Ward noted the first male at a camp on Penny Ice Cap at 2000 m during a blizzard on May 23, and some even sang there on June mornings. Other groups of 2-4 males were seen crossing the ice cap on fine days in June.

Singing was intense for a month, decreasing after the third week of June. There was little song after the first week of July, once on July 10 and the last with low volume on July 15. On several fine clear days up to the end of the third week in June, occasional song was heard throughout the 24 hours in one area where population was dense, with a peak about 03.30-04.00 on three mornings. There was continuous activity there on a few calm nights, but more often a period of no activity occurred before midnight, even at midsummer. Activity was less where the density was lower, and also less later on in July. In the third week of July they were all roosting after 22.30 and there was little activity after 22.00 though it was then still light at night.

On July 29 one male was molting on the crown, and two were in heavy molt on August 2, one with no trace of a tail. The majority, including females, were in this state a day or two later, and by August 17-22 most adults showed new winter plumage in the field.

14 nests were found, nearly all in cracks of boulders off the ground or in cracks on the ground beneath boulders. One nest was open to the sky in a hollow between a *Salix* shrub and a boulder, and another was in a hole in a riverside sandbank, similar to the nest site of a Bank Swallow *Riparia riparia.* Though Manniche (1910) and others stated that the male takes no active part in nest building, I once watched a male carrying grasses several times to a nest far on in construction. Kay (1944) also found a male in captivity carrying material to a nest, without actually taking part in its construction. On June 17 another male carrying a straw in its bill offered it to a female which refused it; the straw was then dropped. One nest was built within four days, on two of which the lining of ptarmigan feathers was added; the first egg was laid on the fifth day. Slightly more time was taken to build one nest at Frobisher (Sutton and Parmelee, 1954a), and about five or six days by a captive pair in Shetland (Kay, 1944). In Alaska one nest was built in only 14 hours and the first egg laid the following morning (Dixon, 1943); such a short time is probably exceptional, even for arctic passerines.

All the nests were closely examined, and one found on July 2 had been used in a previous year; it contained two very clear linings of hair and feathers. It was situated at 300 m in a small valley still covered by almost unbroken snow on June 10. Positive evidence of this adaptation in Snow Buntings has not been found in the literature, though descriptions by Pleske (1928) of nests from high-arctic Siberia suggest that a few had two linings, and Perry (1948) in the Cairngorm mountains of Scotland noticed at the end of the season that one nest had probably been built on the foundation of one or more earlier nests.

Delay in nest construction till after the start of egg laying occurred at one site in a tunnel about 10 feet vertically up a sandbank. On June 18 one egg had been laid on a platform of bare dry sand, without a trace of nest material, about a foot inside the tunnel. The female had already begun incubation, and by the time the fourth egg was laid, only a few grasses and a rough lining of white feathers had been added to form a wide shallow and loose nest. On July 1 the floor of the nest was covered with some sand that had fallen from the roof. There may be less immediate need for insulation in such a site as the permafrost layer is usually absent from well-drained sand and gravel banks though present only a few inches below the surface of typical tundra in June.

Egg laying occurred daily in the morning, in every observed case before 10.00, except at one nest where two days passed between laying of two of the eggs. Nine completed clutches numbered 4, 5, 5, 5, 6, 6, 6, 7, 7, or a mean of 5.7 eggs. One egg disappeared a few days after clutch completion; and even after the young appeared, eggs that had failed to hatch disappeared in some nests while in others they remained till after fledging. At Nettilling Lake clutches were of 5-7 also (Soper, 1928). In the more polar climate of Prince Patrick Island clutch size may be greater than in Baffin; clutches of 5-8 are recorded, with 6 "most commonly found" (Macdonald, 1954, p. 231). In high-arctic Siberia five incubated clutches had an average of 6.2 eggs (Pleske, 1928). Other data on clutch size from various parts of the arctic are summarized by Tinbergen (1939). In Scotland, some unpublished observations indicate that the clutches there may be smaller than in Baffin.

There was a notable spread in egg laying, lasting over a month. The first young seen, on June 19, were judged to have hatched about June 16, and it may be inferred that the first egg had been laid about June 4. With another brood which had newly left the nest on July 29 and whose tails were scarcely showing, the first egg was probably laid at the latest about July 7. The peak of laying activity occurred in the last week of June, resulting in a peak of newly fledged broods from July 19 to 22. There was no evidence of two clutches being laid.

Males have been recorded sitting on eggs (in Witherby 1938 on, in Løvenskiold, 1947), but in common with most observers (Tinbergen, 1939; Nethersole-Thompson in Witherby; Sutton and Parmelee, 1954a, and others). I saw only females on the nests. Certain females fed themselves to some extent, during egg laying and incubation as well as when sitting on young. At one nest the female regularly left for about an hour in the middle of the day to feed during egg laying and incubation. More usually the males frequently brought food to incubating females which took the food without rising from the nest.

Occasionally the females left the nest on the approach of a male with food, flew to the male and showed the typical food-begging behavior of the young, cheeping loudly, fluttering wings and opening the bill till fed. Females also begged frequently in this way, on or near the nest, when sitting on young.

At nearly every closely watched nest the female began to sit from the time the first egg was laid. The sole exception was at one sheltered nest where incubation did not start till the third egg was laid, though the nights were cold and frosty and light snowfalls frequent. Wynne-Edwards (1952b), who observed this habit in the Lapland Longspurs and inferred its occurrence in Snow Buntings also, discussed its necessity in the severe arctic climate; in June even the air temperature may often be below freezing at night.

At no nest was there any evidence of Tinbergen's (1939) observation in southeast Greenland that incubation starts one to three days after completion of the clutch. Though even sitting on the eggs does not necessarily entail effective incubation, as Swanberg (1950) recently discussed—a factor causing further variation in the lengths of incubation periods —I found at several Cumberland nests that the eggs became warm from the first day of sitting.

Several incubation periods were accurately determined; for last eggs in the clutches they ranged from 10¼-10½ to 14½-15½ days, and for first eggs from 12 to 13 days. This clearly reflected a wide individual variation in the efficiency and timing of incubation. At most nests the habit of incubating the eggs during the laying period resulted in a marked spread in hatching. For example, a clutch of four produced three young in over 4 and probably 5 days; other periods, for clutches of 5 and 7 eggs from which 5 and 6 hatched, were 3-4 days and at least 4½ days.

A spread in the time of leaving the nest also resulted from the spread in hatching. Occasionally most or all of the young stayed at the nest till they were all able to leave together, at one nest when the oldest of five was 17 days old and well able to fly. Usually the most advanced young vacated the actual nest, and stayed in the nest crack, a few days before finally leaving. At one ground nest the young all scattered on disturbance when the youngest was only a week old, but they all later returned to the nest. Several times the largest young left the nest crack and spent up to a day or two days on the boulders outside, and then returned to the nest. At five nests the most developed young did not return after first leaving the nest site, and in a few cases the young that were left appeared to have been deserted and some deaths resulted. Periods from hatching till the individual left the nest for the last time varied from 10-17 days as a result of this great variation in dispersal behavior. Sometimes there may be three or more days' difference within the members of one brood. Unless these factors are considered, a bare figure for the fledging period may be misleading.

The female was often seen sitting on the young during the coldest few hours of the night till a time when in one nest the oldest young was 12 days old, and the youngest 8 days old and only three days from finally leaving this nest. Regular feeding of broods occurred till 20.40 on July 20, but there was no sign of any activity at 22.40. The first feeding of a brood in the nest on July 23 was resumed at 02.50. It was confirmed that the most advanced young, which leave the nest before the rest, were usually tended and fed largely or entirely by the male (Sutton and Parmelee, 1954a).

A rich food supply was available on July 21 when strong winds swept large numbers of aquatic insects onto the beach of a lake near Bio. Camp; up to 12 male, several female, and some juvenile buntings were feeding there along with about 15 longspurs. One female bunting was watched making regular trips to a nest on a hillside over 400 yards distant. Like the longspurs, they appeared to bring only animal food, mostly insects, to young in the nest and just out of the nest.

Some adults and young stayed together at least till the end of the first week of August; full grown juveniles were still being fed by adults in heavy molt at this time. The majority of the local population left in the last days of July. By the third week of August very few remained, though many were seen flying strongly south on migration down the Pass, in groups or small flocks.

Breeding success of Snow Buntings (Table 6) was probably greater in those nests where the individuals of a brood stayed till they were all able to leave the nest together. At nests where the most advanced young left early and did not return, one of the young died outside and there were a number of deaths among those left behind at the end. Though fledging time seemed to be a crucial period for mortality, this may not be true, as

TABLE 6. BREEDING SUCCESS OF SNOW BUNTINGS

COMPLETED CLUTCH	NUMBER HATCHED	NUMBER LEFT VICINITY OF NEST	NOTES
7	6	5	
6	5	2	2 died just outside nest.
6	5	3	
6	5	5	Only 4 seen day after leaving
5	5	3	Only 2 seen day after leaving
5	5	4	
5	3	2	One egg disappeared during incubation
4	3	3	
Total 44	37	27	

Percentage of eggs hatched: 84. Percentage of hatched young that left vicinity of nest: 73. Percentage of eggs producing young that left vicinity of nest: 61. Deaths: 3 as nestlings, 5 at time of leaving nest and probably 2 the day after leaving. Several other young were found dead on the ground, away from known nest sites.

the peak fledging time in 1953 coincided with the very cold spell in July and a shortage of insect food. Though Snow Buntings at Frobisher apparently suffered less from the cold spell than pipits and larks (Sutton and Parmelee, 1954a), the data, from Frobisher nests where the clutch and brood sizes were observed without extrapolation, suggest to the writer that the rates of hatching and fledging were probably as low as in the Owl Valley nests.

Wynne-Edwards (1952b) suggested that the dispersal of young longspurs may be related to increasing the clutch size without increasing the size of the nest. In a good summer when breeding success is high and most or all the eggs hatch, as in 1950 at Clyde, early dispersal of passerine young in favorable conditions of weather and food may lead to greater productivity. In a poor summer, like 1953, when many eggs fail to hatch and large broods are consequently unusual, early dispersal may give no advantage, and would probably be selected against in the event of a cold spell.

SUMMARY

The birds were studied in Cumberland Peninsula, about 67°N in east Baffin Island, Arctic Canada, from May to September 1953. Islands and fjords on the Davis Strait coast were visited in May by sledge. Most of the summer was spent in a mountain valley of Penny Highland, an area rich in vegetation and supporting a dense population of passerine birds.

1. At the big Fulmar *Fulmarus glacialis* colony at Cape Searle, not more than 25,000 Fulmars were in occupation of the cliffs at the end of May. Ice cover was extensive, no eggs were seen, and five females taken were not in breeding condition. Most individuals were of the dark phase. Further confirmation was made of the short-billed group *minor* (Kjaerbølling). Body weight is significantly less than in Atlantic birds.

2. There was considerable migration near Cape Searle in May, and in Penny Highland a low-lying route through the mountains was used by eiders flying north in July, and by numerous passerines flying south in August.

3. Ptarmigan *Lagopus mutus* and all predators were scarce, except the Snowy Owls *Nyctea scandiaca* which were feeding almost exclusively on the very abundant lemmings.

4. Autumn molt was rapid in ptarmigan, Lapland Longspur *Calcarius lapponicus* and Snow Bunting *Plectrophenax nivalis*. Gonad regression was slower in the Common Redpoll *Acanthis flammea* which showed some sexual activity as late as mid-July.

5. Re-use of nests by addition of a fresh lining, a timesaving adaptation in the brief arctic summer, was shared by redpoll, longspur, Snow Bunting and Water Pipit *Anthus spinoletta*; of 37 nests, 5 had been relined.

6. In most passerine nests, incubation began with the first egg, and this frequently resulted in a long spread in hatching of the young, and also a spread in the time of leaving the nest. Longspurs finally left the nest when 7-10 days old, buntings 10-17 days.

7. June was cold and snowy and many eggs of longspurs and buntings failed to hatch. All the passerine young were fed to a large extent on the same flying Diptera. A cold spell in July, by reducing the numbers and availability of insect food, resulted in heavy mortality of young.

8. Both species of redpolls *Acanthis flammea* and *hornemanni* bred in the same area, *flammea* greatly predominant in number. A mixed population of *Eremophila alpestris* × *hoyti* was found, with a predominance of pale-faced individuals.

9. Singing and other activity at times persisted throughout the 24 hours in June, especially where the population was dense, but generally there was a 'night' period of no activity before midnight.

APPENDIX

Food Contents of Baffin Specimens

(All Owl Valley unless stated otherwise)

Snow Bunting.

1. ♂ July 11. Piece *Dryas integrifolia* leaf; several leaves, parts of leaves *Vaccinium uliginosum*; fragments thallose lichen; remains several insects; many quartz grains; carrying a *Tipula arctica* and several dark-winged *Cyclorrhapha* in bill.

2. ♂ July 12. 13 1952 seeds *Luzula confusa;* some unidentified organic matter; much quartz and some felspar.

3. ♂ July 13. No plant material; many *Chironomidae*.

Redpoll (All *flammea* except 1, which was *hornemanni.*)

1. ♂ May 24, Cape Searle. Many seeds *Oxyria*.

2. ♂ June 29. 100 imagines *Sciara* sp.; some seeds probably *Luzula confusa;* testa 3 seeds; 50 quartz and some felspar granules.

3. ♂ July 16. Tip small lanceolate leaf; many insect remains, most unrecognizable, 1 small *Cyclorrhapha* and wing of a larger sp.; numerous quartz and felspar grains.

4. ♀ July 16. 20 1952 seeds *Salix* sp.; unrecognizable insect remains.

Lapland Longspur.

1. ♂ C. Searle, May 26. Pieces leaves *Dryas integrifolia*; no animal matter; quartz grains.

2. ♂ June 27. 5 *Sphagnum* heads; peristome teeth *Polytrichum* and other parts; young leaves *Salix herbacea*; 2 broken spiders.

3. ♂ July 11. Old stolons, 3 fresh buds *Poa arctica*. Grass seed (*Poa arctica* ?) and old roots; quartz and felspar.

4. ♂ July 11. 15 small seeds, probably *Pyrola* or *Saxifraga*, 2 seeds probably *Oxyria;* parts of spider legs; much insect material, largely broken; several ♀♀ *Aedes*, a dark-winged *Cyclorrhapha* and parts of a bottle fly *Calliphoridae*; small piece of animal bone, probably from a lemming.

Horned Lark.

1. ♀ June 27. Several pieces green thallose lichen typical of *Sphagnum* marsh, 1 piece 10 × 10 mm and other smaller pieces; 1 seed *Poa arctica* or *Arctagrostis*; pieces *Sphagnum* and *Polytrichum* sp. leaves and a *Polytrichum* capsule; quartz granules.

Rock Ptarmigan.

1. ♂ near Padloping, May 28. 8 berries *Arctostaphylos alpina*; pieces leaves and stem *Cassiope tetragona.*

2. ♂ near Padloping, May 29. Tips *Ledum* sp. leaves; 1 leaf, 2 berries *Arctostaphylos alpina*; 1 *Salix* catkin; many flower heads *Cassiope tetragona*; many pieces stem and buds *Vaccinium uliginosum.*

3. ♀ near Padloping, May 29. Pieces stem and buds *V. uliginosum*; several *Ledum* leaves; berry *Arctostaphylos alpina*; small pieces *Cassiope tetragona.*

4. ♀ Pangnirtung, September 4. Buds *Salix herbacea*; some *Cassiope tetragona* seed pods and flower heads; a few *Luzula* heads; leaves *Salix arctica*; parts *Stellaria longipes*; 2 pieces of grass.

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BIRDS OBSERVED AT BATHURST INLET, NORTHWEST TERRITORIES

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INTRODUCTION

IN CONJUNCTION with the Canadian Wildlife Service's primary investigation on the barren-ground caribou at Bathurst Inlet, MacKenzie District, observations were made on the bird fauna. Field studies extending from May 14 to September 6, 1950, were restricted to this area. A six-day trip was made from July 25 to 30 in a 22-foot freighter canoe powered by a five-horsepower outboard motor along the western coast of the inlet to Portage Bay and back to camp along the eastern inlet. A second trip to the mouth of the Western River took place between August 5 and 7.

This report consists of data on the spring and autumn migrations, nesting habits, seasonal activities and habitat preferences of the birds observed in this area.

No previous accounts of birds in this area could be found in the literature. The only record available has been supplied by Dr. C. H. D. Clarke, who in his own notes recorded 14 species here between August 25 and 27, 1942.

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The writer wishes to acknowledge the permission to use the data collected by Dr. C. H. D. Clarke, Department of Lands and Forests, Toronto, Ontario, on his short visit to this area. Appreciation is also extended to Mr. Earl Godfrey, National Museum of Canada, Ottawa, for the determination of the subspecific rank of the specimens collected. Mr. J. P. Kelsall made available for this report his bird observations recorded throughout this period.

ANNOTATED LIST

The total number of species observed was 50. Of these nine are transients. Nests of 20 species were found. Fourteen other species were suspected of nesting, although their nests could not be located. Four species occurred sporadically and one species could not be positively identified. One was recorded on the basis of remains and one was taken from Clarke (MS.)

YELLOW-BILLED LOON *Gavia adamsii.* This species was fairly common along the shores and small bays of the inlet. It was first seen on June 15. The largest number observed together was nine, but usually only two or three were observed together. Intensive searching to locate their nests proved unsuccessful. Seven were observed by Clarke. No common loons were seen in this area.

PACIFIC LOON *Gavia arctica.* Adults were observed from June 13 to August 26. They were usually in pairs, but were occasionally seen in groups of six or seven. Some were observed on inland lakes as well as along the coast. However, no nests or young were found, although a pair of adults was observed on several occasions on one of the inland lakes, indicating the possibility of nesting.

RED-THROATED LOON *Gavia stellata.* The first pair was observed on June 19 on a small pond. They appeared to be less common than the other species. This may be the result of observational difficulties because of their preference for small inland ponds rather than the open salt-water bays. On August 7 one juvenile was observed swimming with the adults. This was the only record of their nesting in this area.

WHISTLING SWAN *Olor columbianus.* Their spring migration lasted from May 30 to June 21, although a single swan remained from June 23 to July 3. Until the time of our departure on September 6, no swans were observed on their fall migration. From the data collected there appears to be no particular time of day when swans migrated. Most of them were seen to migrate on calm, clear days following a period of stormy weather. On eight occasions swans were observed feeding and resting on Wolf Lake. At this time the lake was covered with ice except for a narrow strip along the shore. The other lakes in the vicinity were completely frozen and no swans were seen on them. Occasionally, a few were observed feeding in the shallow, salt water of the inlet.

They exhibited little fear of human beings and could be approached to within 30 yards without flushing. Usually they did not associate with the flocks of old squaws, white-fronted geese, and pintails which were also in the lake. After a short resting period they flew in a northeastern direction. None of them remained to breed here. The natives implied that these swans nest on the Kent Peninsula.

CANADA GOOSE *Branta canadensis.* The first flocks of geese, numbering about 60, were observed on May 25 and 26. This northeastward migration extended intermittently until June 10, although a flock of seven was seen flying randomly in a southeastern direction down the inlet on June 29. The total number of geese observed flying northeastward was about 500, of which the largest flock numbered 100 (June 15).

The geese that arrived in May remained longer in the inlet than those which arrived later in the season. These did not stop over, but continued migrating. The geese were observed, as was the situation with the swans, more frequently on clear, calm weather although they did not fly in cold foggy weather, and during snowstorms. Their southward autumn migration began on September 5. At this date thin ice had formed on the inlet and the recently fallen snow remained on the tops of the high ridges.

BRANT GOOSE *Branta bernicla.* Five were observed once on May 31. This was the only record of their presence.

WHITE-FRONTED GOOSE *Anser albifrons.* Eight were observed on Wolf Lake on two occasions, two on June 5 and six on June 8.

SNOW GOOSE *Chen hyperborea.* A total of 55 snow geese was observed as follows: 25 on May 27, 14 on May 30, two on May 31, seven on June 6 and seven on June 13. No geese remained in this area to breed.

PINTAIL *Anas acuta.* A flock of 13 males arrived on May 31. Their numbers continued to increase and in mid-June about 30 were observed on Wolf Lake. These ducks seemed to prefer this shallow lake which had a dense growth of vegetation near the shore. The flocks consisted almost entirely of drakes. Of 217 pintails, 79 were males, 19 females and 119 unidentified. No nests were found on the shores of Wolf Lake or the other nearby lakes in the wet flat valleys. One female with seven downy young was observed swimming in a small stream on July 25.

GREATER SCAUP *Aythya barila.* Two pairs were carefully observed on Wolf Lake on June 20. Four on June 27 and two on July 3 were seen on a nearby lake.

BUFFLE-HEAD *Bucephala albeola.* The identification of this species is questionable because it was observed briefly and only once (June 24).

OLD SQUAW *Clangula hyemalis.* It was the commonest of all the species of waterfowl. From June 1, when the first ones were seen, its numbers increased throughout June and July. These flocks remained on Wolf Lake then later moved to the open water of the inlet. No nests could be found, but frequently pairs were observed on small inland ponds and these birds may have been nesting.

AMERICAN EIDER *Somateria mollissima.* The first specimen was obtained on June 3 from the Eskimos who caught one in their fish nets. The largest number was counted on June 29 in an open lead in the inlet. A total of 53 male and 36 female American Eiders, 19 male and one female King Eider, 65 Old Squaws and four Arctic Loons was observed. Three American Eider nests contained five, five and six eggs.

KING EIDER *Somateria spectabilis.* On June 29, 19 males and one female were observed. One King Eider nest contained two eggs and four young. Three broods of five, seven and nine juveniles were observed.

WHITE-WINGED SCOTER *Melanitta deglandi.* This species was not common in this area. A flock of nine was seen on July 27 and two on July 28.

RED-BREASTED MERGANSER *Mergus serrator.* This species was also rarely observed. On July 6 a pair was seen on one of the inland lakes.

On August 6 four were observed flying up the inlet. No nests were found.

AMERICAN ROUGH-LEGGED HAWK *Buteo lagopus.* Fourteen were observed migrating singly northward as follows: three (May 14), four (May 15), three (May 21), and three (May 28). Throughout the season they were common in the area. Clarke also remarked on the relatively large numbers of them.

Six nests were found and from these considerable data were collected on the life history of these hawks. One nest close to our camp was under observation throughout the nesting season. This nest was situated on a small ledge of a rugged cliff about 20 feet above the ground. It consisted of layers of dead twigs. On this cliff a pair of ravens and peregrine falcons also established their nests and successfully reared their young. The three species were continually fighting with each other in defense of their own territory. The nest of the raven was between the hawks.

The rough-legged hawks began repairing their nest about May 21. On June 28 three eggs had been laid. Four recently-hatched young were found on July 8. They began to fly on August 19. The adults were very excited by the approach of observers in the vicinity of their nest. This behavior was more intense when the eggs had hatched. Then the adults would circle over us, uttering loud cries, even when we were one to two miles from the nest.

The five other nests were found on cliffs that faced, in most cases, the southeastern direction. They contained four downy young (July 27), three downy young (July 28), two young (August 6), five juveniles (August 7), and one nest that could not be reached for examination. Because of the difficulty in reaching the nests only five young were banded on July 27. These young were docile, not aggressive, and their flight feathers were just beginning to develop. One nest containing two juveniles on August 6 was vacated on August 16. In one instance two old nests were found near the occupied one. One deserted nest was found; it had been repaired, but was not utilized.

The litter about the nests consisted mainly of lemming fur, bones of caribou, dog, and ground squirrel, and a few feathers of snow bunting. Two lemmings were found below one nest. The size of the pellets were about 1 inch by 3 inches. They consisted mainly of lemming fur and bones.

GOLDEN EAGLE *Aquila chrysaetos.* Four single observations of this species were made on June 4, 5, 19 and August 25. A pair was seen on June 23. Although nesting activities were suspected, no nests were located. No instances of eagles preying on caribou calves were observed.

PEREGRINE FALCON *Falco peregrinus.* This species was fairly common. Four pairs established their nests on the ledges of a rock ridge about 10 miles in length. Their nests consisted of dead twigs and other vegetation. Usually they were more accessible than those of the rough-legged hawks.

Five nests were found during the season. Complete nesting data were recorded for two of them. The nesting period of one pair began on May 21. It contained four eggs on June 28 and July 1. Three of the eggs hatched by July 23 and were still in the nest on August 4. The other nest was found on June 3. It contained three eggs on July 3, which had hatched by July 21. These downy young were banded on August 2. Two of them were large and docile, the other was small and aggressive. On August 23, this nest contained only one young. Presumably the other two had died from some unknown cause. On August 6, a nest containing two young with tail feathers partly developed, the rest of the body being covered with the downy plumage, was found. In June and July, both of the adults returned to defend the nest when it was under observation, but in August only the female was present at the nest.

At their nests and feeding stations bird feathers and remains were common, and occasionally lemming remains. On June 10, a peregrine made two unsuccessful dives on a shorebird. Their hunting activities increased considerably during the latter part of August. On several occasions peregrines were observed to be actively hunting late in the evening.

ROCK PTARMIGAN *Lagopus mutus.* About 15 adults were observed throughout the season. On May 16, the first record of their presence was noted. There was no evidence to determine when or if they migrated into the area previous to our arrival. A few were seen in May but they became very scarce from mid-June until late July. Their disappearance, or apparent inactivity, may have been associated with their nesting activities. Information was obtained from Mr. Bud Hodgsen, Chief Geologist at Armstrong Lake, Northwest Territories. He reported that the ptarmigan arrived about May 1, 1950, and that they were abundant in 1949.

On June 4, a male exhibited territory defense. The development of the ova was determined from a female collected on May 28. The size of the ova ranged from 5 to 13 mm. Many small follicles also were contained in the ovaries. A nest containing seven eggs was found on July 3. Another nest discovered on July 13 which had been recently vacated, contained one infertile egg and the parts of the shell of five other eggs. By August the young chicks were seen moving with the hens. The following brood sizes were observed: seven and eight (August 8), nine (August 9) and seven (August 18).

Data on stomach analysis, molting processes and predation could not be collected in detail. The crop of two specimens collected in May, contained the following plant remains: the leaves of Labrador tea, buds of willow and alder shrubs, and *Vaccinium* berries. The adults were not observed frequently enough to collect data on the molting pattern. Two adults collected on May 16 had not started to molt. One collected on May 17 was molting about the neck. A male observed on July 6 had vivid red patches around each eye. Its neck, part of the chest, back and wings were brownish in color. From the frequent occurrence of feather and bone remains, one would assume that ptarmigan are preyed upon heavily by foxes. Perhaps this heavy predation may have been the cause of their scarcity in this area.

SANDHILL CRANE *Grus canadensis*. Four sandhill cranes were observed by the natives on June 1. The men shot one of them and it was identified by us. One skeleton was found on June 24.

SEMIPALMATED PLOVER *Charadrius semipalmatus*. This species arrived later in the spring than either the pectoral or Baird's sandpiper. The first plovers, a male and a female, were observed on June 9. Throughout the summer they were common along the edges of shallow ponds, sandy beaches, and especially on the sand flats at the mouth of the Burnside River.

On July 4, a female was observed performing the characteristic act of dragging both wings and its tail on the ground to distract the observer from its nest. The first downy young were not found until July 25. Five juveniles were banded on July 27. By August 3 the juveniles were capable of flying and leading an independent life. Some adults were flying about in large flocks on July 29, preparing for the autumn migration. By August 23, the adults were migrating southward.

GOLDEN PLOVER *Pluvialis dominica*. On June 13, nine were observed on a dry gravel slope. Single observations were made on June 24, June 29, and July 1. No nests were found in the area near our camp where they occurred sporadically. They did breed about 15 miles up the inlet on the western coast. In this area they were very abundant, and one dead juvenile was found. On September 5, about five adults were noted migrating south.

RUDDY TURNSTONE *Arenaria interpres*. Only three of these beautifully colored birds were observed migrating northward on June 19. They remained in the Burnside Delta for a very brief time.

PECTORAL SANDPIPER *Erolia melanotos*. The earliest record of their arrival was May 31, on which date two specimens were collected. Shorebirds, which may have included this species, were heard migrating during the night as early as May 27. These birds were fairly common in the area, although not as numerous as the other species of shorebirds.

A pair remained in the flat, marshy sedge area near our camp, but their nest was not located. From June 17 until late July their nocturnal 'hooting calls' were frequently heard.

WHITE-RUMPED SANDPIPER *Erolia fuscicollis*. They arrived in the area on June 5. On this date a few were observed feeding along the shore of an inland lake. They were not common. No nests were found, but there was ample evidence to conclude that they did nest along the flat marshy areas.

BAIRD'S SANDPIPER *Erolia bairdii*. These sandpipers, which arrived about June 2 or perhaps a few days earlier, constituted about the largest part of the shorebird populations. They were noted to feed on the caribou carcasses scattered about the Eskimo's tents. Some were observed feeding on insects on the high gravel slopes. On June 16, the first mating display was recorded. Juveniles were seen flying about on July 13 and August 2.

LEAST SANDPIPER *Erolia minutilla*. Although no specimen was collected, it is fairly certain that this species occurred in this area. Kelsall observed a shorebird which he referred to this species feeding beside a savannah sparrow on the shore of Wolf Lake. It was about the same size as the sparrow, and had yellowish legs, a black, short bill and a heavily flecked breast.

SEMIPALMATED SANDPIPER *Ereunetes pusillus*. This species was the commonest shorebird in the area. On June 19, the first specimens were collected; they had arrived before that date, although later than the other shorebirds. They were found along the shores of the inlet, the wet flat sedge area of the Burnside Delta, and in other sandy areas.

One nest containing two eggs was found on June 26. The female was flushed from the nest and briefly perched on a nearby small willow thicket. One juvenile was banded on July 29. Juveniles were also seen on August 2.

SANDERLING *Crocethia alba*. These shorebirds arrived about June 13. On June 19, a flock of about 40 was observed flying along the shore of the Burnside Delta. They were noted to feed upon the waste materials and the caribou carcasses which were scattered about the Eskimo camps. None of them remained in this area to breed. Some were observed in flocks with other shorebirds on July 28. A few fall migrants were observed on August 23 and 24 at our permanent camp site.

NORTHERN PHALAROPE *Lobipes lobatus*. The first phalaropes which arrived on June 15 and 17 were observed swimming and feeding on a very small pond behind our tents. They became very common throughout the summer and as many as 14 pairs were counted in a small area on the Burnside Delta. No nests were found, but there was evidence from their behavior that they had established nests in this area.

POMARINE JAEGER *Stercorarius pomarinus*. Jaegers were infrequently observed during the midsummer season. A pair seen on June 13 was perhaps migrating northward. The pair did not remain in the area to breed. Neither the parasitic nor the long-tailed jaegers were observed.

GLAUCOUS GULL *Larus hyperboreus*. The cries of these gulls were heard on May 25, but the first ones were not observed until May 27. Their numbers greatly exceeded the other species of gulls, which was also noted by Clarke.

On June 6 and 14, two nests were found on a large island; one of them contained two eggs and the other was empty. On June 29, three eggs were found in the latter nest. Three juveniles were chased from another island into the water and later banded. On July 22, on still another island, four young were banded, and on July 28 three other young were banded. Four nests were found on a small shale island. One nest contained one chick and one unhatched egg; another had one egg, and two nests were empty. Two downy young were observed swimming away from the island while we were examining the nests. On July 30, a nest containing two young which had just hatched from the eggs was found.

HERRING GULL *Larus argentatus*. These gulls may have arrived as early as May 24, but none was seen until May 29. Bud Hodgsen at Armstrong Lake reported that they arrived there on May 11. They were very common. As many as 100 gulls were seen in one flock on July 25. Clarke also remarked on the large numbers of gulls he saw here. No nests were located, but juvenile gulls that may have belonged to this species were observed. The adult gulls feed upon the caribou carcasses and the marine material along the littoral zone.

Without specimens it is impossible to identify the subspecies, Thayer's gull *L. a. thayeri*. A few gulls with a red spot on the lower mandible and greenish yellow legs may have been the California gull *Larus californicus*.

SABINE'S GULL *Xema sabini*. This gull was observed only once on June 14. It was perhaps a migrant flying north.

SNOWY OWL *Nyctea scandiaca*. No snowy owls were seen, but the remains of one was collected.

SHORT-EARED OWL *Asio flammeus*. A pair was seen on one of the small islands opposite our camp. They were observed intermittently throughout the summer in different areas. No positive evidence of their nesting habits was discovered.

HORNED LARK *Eremophila alpestris*. The first approximate date of their arrival was May 28. They were very common, as Dr. Clarke also noted, and were found on the dry, upland areas.

Sexual activities were observed from May 31 to June 19. On June 21, larks were noted to be gathering food and carrying it to their young. One nest was found on June 20 which contained five eggs. Juveniles commenced to leave the nest by July 27. Later flocks composed of both immatures and adults were flying randomly about preparing for their departure from the area.

Although no specimens were collected from their geographic range and the pale, yellowish white facial markings, these birds are undoubtedly Hoyt's horned larks.

NORTHERN RAVEN *Corvus corax*. This species had already established nests before our arrival on May 13. Besides the nest observed and discussed in the section on rough-legged hawks, two other deserted nests were found.

The juveniles left the nest and were flying on June 28. The largest flock of ravens was nine. They remained in the area at least until September and possibly later.

AMERICAN ROBIN *Turdus migratorius.* This species was not observed on this survey, but was recorded by Clarke.

GRAY-CHEEKED THRUSH *Hylocichla minima.* The song of this secretive bird was heard at least a week before it was observed on June 20. These thrushes were common in the valleys which contained a dense growth of willow and dwarf birch shrubs. Although no nests were found, there certainly were nests in the areas under observation.

AMERICAN PIPIT *Anthus spinoletta.* On May 29, a large flock seen on a dry exposed slope marked the arrival of these birds in the area. They remained throughout the breeding season near the top of the range of hills. One nest found on July 5 contained five eggs. Examination of this nest on July 23 showed it to be empty. Another nest contained four young, of which two were dead.

After the termination of the nesting period, the larks no longer remained on the high ridges but moved to the low, wet flat areas. By late August, the flocks were composed of adult and immature birds which were preparing for their autumn migration.

ARCTIC REDPOLL *Acanthis hornemanni exilipes.* Clarke observed this species and the redpolled linnet, *Acanthis linaria.* During this study the two species were not distinguished and the specimens that were collected were identified as the above subspecies.

The redpolls were present in the area before our arrival on May 14. The commonest species, they inhabited the areas that were covered with willows, dwarf birch, and alder.

About mid-May they were flying in flocks of about eight to 10 birds, occasionally forming pairs. On May 23, a female was observed collecting material for nesting purposes. Data on the eight nests observed are as follows: one contained five eggs on June 9, five young on June 21; the second contained five eggs on June 11; the third contained four eggs on June 21; the fourth contained five eggs on June 23; the fifth contained three eggs (abandoned) on June 23; the sixth contained four eggs on June 27, four young on July 3, the seventh contained four juveniles on July 5, and the eighth contained two juveniles on August 1. A juvenile was also seen on July 27. From the above data there is some evidence to suggest that this species may produce two sets of eggs during the summer season.

SAVANNAH SPARROW *Passerculus sandwichensis.* A few sparrows were seen on June 8. They occurred in greater numbers than the other species of sparrows. Throughout the season, these sparrows were found along the banks of lakes, small ponds, creeks, and other low, wet bushy areas.

One nest found on the edge of a small pond on July 8 contained five eggs. Another nest observed on July 12 contained about four young. It was later destroyed by a hawk. By July 22 the juveniles and adults were flying about in flocks of eight to ten. After mid-August, scattered small flocks were flying from one willow thicket to the next. At this time of year strong winds and scattered showers were prevalent.

TREE SPARROW *Spizella arborea arborea.* On June 5 the first record of the occurrence of this species was noted. Tree sparrows were common (Clarke) in the areas covered by willows, dwarf birch, and alders.

Four nests were found. The first contained six eggs on June 24; the second contained three eggs and two young on July 6; the third contained six eggs on July 7; and the fourth contained one egg and four recently hatched young. The birds began forming flocks about the same time as the savannah sparrows.

HARRIS'S SPARROW *Zonotrichia querula.* Their low, repeated whistling notes were heard about the same time as the thrushes' songs were recorded. In early June these noises would continue from about eight o'clock in the evening until two in the morning. This bird was fairly common (also noted by Clarke) but seldom observed. No nests were discovered, but judging from the activity of the females, the young had left the nest by about July 18.

WHITE-CROWNED SPARROW *Zonotrichia leucophrys gambelii.* Not as common as tree or savannah sparrows (also recorded by Clarke), the white-crowned sparrows usually remained hidden in the dense growths of alder, willow and birch. They were very seldom observed, and although they nested in this area, no nests could be located.

LAPLAND LONGSPUR *Calcarius l. lapponicus.* The first record of their arrival was a female observed on May 21. Ten days later four males were seen feeding on the ground in a sedge-covered flat. They were probably the second commonest species (also recorded by Clarke), the commonest being redpolls. The longspurs inhabited the low, wet, humpy sedge flats.

Much information was recorded on the nesting habits of this species. It appeared that some of these birds raised two broods in the same season, but no proof could be secured. Data on the four nests observed are as follows: the first contained four eggs on June 16; the second contained four eggs on June 26, four downy young on July 7, and four juveniles on July 13; the third contained five eggs on July 5, three eggs and two downy young on July 7, one egg and four young on July 8, five young on July 9-10, three young and two dead on July 11, three juveniles (ready to fly) on July 15, one alive and two dead on July 17; a fourth nest contained four recently hatched young on July 6. The death of the young in the third nest was caused by cold, wet weather. The immature birds were flying from at least July 12 to August 4.

SNOW BUNTING *Plectrophenax nivalis*. These birds had migrated into the area before our arrival on May 14. Until about May 24 they were very common, and flocks numbering about 40 birds were observed. Their numbers decreased after this date. Only one or two pairs remained in the area and had nests on the cliffs of a high rocky pass. On July 20, a female carrying food in its bill was observed in the vicinity of this pass. Juveniles were seen here on August 17.

Their fall migration had commenced about August 23. During the latter part of August they were becoming more abundant.

SUMMARY

At Bathurst Inlet the spring migration of redpolls, snow buntings and rough-legged hawks took place in May. Geese and swans migrated northeastwards from May 25 to about June 21. Shorebird migration extended from May 27 to June 20. By June 24, the largest numbers of birds, mainly nesting species, were observed.

Ravens and hawks established their nests first, then redpolls and the other species. The nesting period for most of the species occurred from mid-June until mid-July.

With the termination of the nesting period large numbers of juveniles were observed flying in flocks with the adults from about July 10 to August 23. In late August most of the birds had left the area.

SOME OBSERVATIONS ON THE SCHOOLING MOVEMENTS OF THE ALEWIFE IN LAKE ONTARIO

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IN ADDITION to the motions involved in spawning and general swimming, the alewife (*Pomolobus pseudoharengus* Wilson) schools of Lake Ontario perform two characteristic movements: the mill and the 'roller-coaster.' The mill has often been reported in the literature (Morrow, 1948), but the roller-coaster has not been described previously.

The following observations concerning these two behavior features, made possible through the financial support of the University of Toronto, the National Research Council and the Research Council of Ontario, were made along the Adolphus Reach shoreline of the Bay of Quinte on June 25, 1950. The day was sunny and the surface of the lake was placid. The air temperature was 22.5°C. and the mean water temperature of the previous 24 hours, five feet below the surface, was 17.6°C. A large number of schools entered the shallow water at this location at 2.00 P.M.

In the roller-coaster movement, each school undulated from the surface of the water to the bottom (6 feet) over a zigzag course. The school frequently broke the surface of the water, but the surfacing was not accomplished simultaneously by every member of the school. The leaders broke the surface first and the rest of the school surfaced in follow-the-leader fashion. The splash produced is characteristic; in fact the alewife schools may actually be identified by the sound of the splash.

The mill is produced by the school forming a circle. The formation of a mill was observed when one of the schools approached a semi-circular indentation of the shoreline formed by a gravel spit extending into the lake. The school turned toward shore when encountering the spit and in consequence turned at an angle of about 180 degrees. The circumstances under which this mill was formed support the following explanation of the mill by Parr (1927). Parr suggested that when a school turns at an angle of more than 180 degrees, fish passing each other in the opposite direction exert a stronger visual sitmulus than those travelling in the same direction. Thus, the fish on the inside of the turn incline toward each other and members on the outside follow them and soon the school is circling. Possibly, such a visual stimulus might also result from a school passing an isolated object in the water. In the Port Credit area commercial fishermen reported that adult alewives often mill about the oil cribs and a breakwater a short distance from the Credit River mouth. Commercial fishermen also report that mills often occur during the spring and summer months in the surface water offshore when they are not associated with any structure or feature of the shoreline. The occurrence of the mills coincided consistently with the occurrence of warm sunny days and placid water. When confirmed to holding tanks in the laboratory a school would form a mill which was maintained continuously unless disturbed.

Mills formed in laboratory tanks offered opportunities to observe the feeding movements of the alewife school. These observations and those taken in the field showed that the alewife does not take its food by random straining of the water. When *Daphnia* were introduced into the laboratory tank along the course of a mill, the milling ceased and each alewife pursued its prey. Strained liver, which formed a cloud when introduced into the tanks, also had the same effect excepting that it was consumed by swimming through the cloud and the breakdown of the mill was not into individuals but into numerous small groups. A possibly similar relationship between the compactness of a school and the size of the food upon which it feeds has also been shown for the mackerel (Sette, 1950).

Although in the laboratory tanks the mills were disrupted by feeding, the area which the school occupied was too small to determine whether the unity of the school was lost. Observations obtained in the field during 1950 showed that a school, when feeding in its natural habitat, does not lose its unit organization. The following description of the manner of feeding of alewife schools upon insects on the surface of the water was taken from observations made at the apex of Point Pleasant on July 28, 1950, and is identical with the behavior seen in observations made in other areas of the Bay of Quinte region. At dusk the schools of adult alewives may be seen swimming inshore along the bottom in approximately eight to ten feet of water. Suddenly, a school will move into shallower water, even to a depth of one foot and feed upon the insects at the surface, with adult alewives independently breaking the surface. The continuity of the school is not lost however and the splashes from the surfacing fish define the limits of the school. Any disturbance, such as a wave, causes them to re-form into their original swimming formation and leave the shallow water.

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THE ANTIQUITY OF THE SHEGUIANDAH SITE

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INTRODUCTION

THE SHEGUIANDAH site covers a 26-acre hilltop near the northeastern corner of Manitoulin Island in Lake Huron. It was discovered in 1951 (Lee, 1953).

In the four years following the discovery, several related investigations were carried out (Lee, 1954, 1955) in an effort to determine the nature of the site, its age, and cultural relationships. Large surface collections were made. Excavations in the habitation area revealed at least five successive and distinctive assemblages of man's tools, the lower two of which occurred in deposits regarded as glacial. Quartzite flakes produced by man and a few finished artifacts were found in strata below the till. Ancient quartzite quarries were found under as much as 5 feet of Indian chippings and quarry debris. Artifacts were found under thick beds of peat in bogs on the site. Considerable antiquity was indicated in all situations. The minimum date for the preceramic elements could be set approximately at 4000 years, in terms of the former Nipissing Great Lakes, whose waters cut a deep notch into the hillside, 71 feet above the present Lake Huron. But how far back in time might the site extend? If the authorities consulted were correct, some of the artifacts were embedded in glacial till and must be older than the last advance of ice over the site.

Authorities in various disciplines were encouraged to visit and examine the site throughout excavations. In 1954, about 65 members of the Michigan Geological Society arrived in one group, conducted by Dr. John Sanford of Wayne University. Mr. L. J. Chapman of the Ontario Research Foundation and Dr. Gorman of the University of Toronto examined the trenches in great detail, as did Dr. B. Liberty of the Geological Survey of Canada. Dr. Sanford continued his investigations from time to time, as in other seasons. The outstanding authority, Dr. Ernst Antevs of Globe, Arizona, who had earlier worked in this region, undertook a detailed study of the problems by correspondence with several geologists who had examined the site and later he went over the evidence submitted by the writer on two occasions in Globe. Detailed pollen studies were performed by Dr. J. Terasmae. Valuable suggestions concerning this paper have been made by Dr. E. Antevs, Dr. J. Sanford, Dr. J. Terasmae, Professor T. McIlwraith, Mr. Frank Ridley, Dr. E. Deevey, and Dr. R. Woodbury, who have read it. To them and to numerous others I extend appreciation and thanks.

NATURE OF BEDS AND STRATIGRAPHY

Habitation area. Within the habitation section of the Sheguiandah site, an area of 1250 sq ft has been carefully excavated to varying depths. In addition, a small test pit (Figures 1A and 10) was dug to bedrock for geological purposes. At least five occupation levels were encountered in the upper 30 inches of the deposits in the habitation section. Our primary concern in this paper is with Level III, which includes typologically early projectile points, and with Levels IV and V, which are believed to be within glacial deposits (Table 1).

The test pit represented in Fig. 1A was dug on the crest of a slight rise of land. The humus layer (a) is normally some 5 or 6 inches thick in this area of the site, but is very thin on the rise of land. It contains chippings and quarry debris about equal in volume to the soil itself. Beneath it is the transitional zone (b), made up of fine buff-colored soil which may represent the effects of rain wash from slopes, prior to the full development of forest cover. It occurs usually as a 1-inch layer, but may thicken on an uneven till surface, as in this profile. Projectile points, probably of considerably different ages, occur within this zone.

The deposits (c and d) beneath the transitional layer are "an intimate and unsorted mixture of materials ranging from clay to boulder size" (Dr. John Sanford). The upper half (c) contains the large, thin, secondary-flaked bifaces of Level IV; the lower half (d) produces the small, thick bifaces of Level V. Deposition must have occurred twice. Separation is based not only upon artifact typology and frequency, chip frequency and the condition of chips, but upon the observed presence of some small, thin, horizontal 'lenses' of fine gravels and sands at various levels in the lower half (d) only. Although these seldom exceed 18 inches in diameter, they sometimes seal off artifacts beneath them (Lee, 1955, p. 66). Lumps of disintegrated schist increase greatly in number with increasing depth. Boulders and blocks of black shale increase in size downward in the deposits (Figure 6). Several rounded areas of clean sand have been observed in the lower half; some were examined by Dr. Sanford, who believes that they were deposited as frozen lumps.

A thin (2-4 inches) sorted layer (e) occurs under the unsorted deposits. It was identified by geologists in the field and in the laboratory as a "meltwater deposit right off the ice." A large notched biface (Lee, 1954, Fig. 36: 2), two scrapers and some flakes of quartzite were found in this zone. Unlike the worn flakes in the overlying unsorted deposits, these are sharp-edged.

The sands were deposited on and between boulders (Figures 7 and 10) up to 30 inches in diameter, long axis (not shown in Figure 1A), which completely pave large parts of the habitation area at about 30 inches' depth. Below these are gray silty clays (f), which have produced a large broken biface tool, several battered objects believed to have been bifaces, and some flakes.

Swamps or peat bogs. Elsewhere on the site, 400 sq ft of trenches were opened in four swamps (Figure 2), in the hope of finding organic materials preserved by tannic acids and by the "antiseptic low oxidation conditions" (Cain, 1944, p. 124). Further, any included archaeological remains might be dated through pollen studies and radiocarbon analyses of the peat beds (Figure 12).

Although artifacts were found embedded in clays beneath the peat in all swamps, Swamp 3 is of particular interest, because the maximum accumulation of peat was found there. A trench 3 by 5 feet was excavated to a depth of nearly 9 feet (Figure 1B). Under a modern root mass of sedges (a) was a dark peat (b). In this were several thin layers of charcoal, which may have resulted from forest fires. From 14 to 38 inches, a dense greasy brown peat (c) was encountered. Numerous forest fires were again indicated. At 38 inches a marked change was noted in the character of the peat; a fibrous, spongy material (d) extended down to 50 inches. It contained quantities of well-preserved plant fragments. A white spruce log (identified by J. D. Hale of the Ottawa Forest Products Laboratory), 7 inches in diameter, with 148 growth rings, was found. A portion of it was submitted to the Laboratory of Tree-ring Research, University of Arizona.

A basal gray and greasy peat (e) rested upon artifact-bearing gray clays (f). A few spruce cones occur to the bottom of the peat accumulations.

In 1939 Eiseley (p. 132) stated that peat bogs in eastern Canada and the eastern woodland of the United States had supplied no human traces such as "to provide a fixed point in time for our contemplation of the post-glacial activities of man in the New World." Such traces are now available at Sheguiandah (Figure 12), in quantity. Radiocarbon methods have come to our assistance in establishing the great age of the deposits. The basal 1-inch layer of peat, itself representing a considerable time span, has been dated at 9130±250 years (W-345) by the U.S. Geological Survey (Lee, 1956, p. 79). The underlying cores, chips and flaked objects are necessarily older than this date.

A pollen profile (Figure 3) by Dr. J. Terasmae sheds light on probable happenings in Swamp 3. It is seen that the underlying sands, gravels and red-brown clays contain considerable to abundant fine plant debris, well below the peat development. These deposits have been called glacial till by several geologists. Dr. Sanford and others favor a glacio-fluvial origin. Dr. Terasmae, on the other hand, believes that the plant debris "is not characteristic of deposits of glacial origin (outwash) in this area" (personal communication).

Peat could not begin to form here until the hilltop was exposed by the lowering of Algonquin waters. When this took place, the climate was already fairly warm. Some time later, during the formation of the fibrous peat (d), a cold period prevailed, as is indicated on the pollen chart by the increase in spruce (*Picea*) and NAP (nonarboreal pollen) accompanied by a decrease in pine (*Pinus*). There is a strong possibility that this cold period may correlate with the Cochrane glacial advance. A warmer period followed. "Abrupt changes in pine and spruce values above the fibrous peat, as shown in Figure 3, may be due to forest fires" (Terasmae, personal communication).

GEOLOGICAL PROBLEMS

It has been indicated in earlier reports that the geology of the Sheguiandah site is extremely complex. There are problems involving the curious reversed drainage of three swamps, with variations in thickness of peat; the occurrence of a Point Peninsula site at the base of the hill and only 10 feet above the present level of Lake Huron; the nature and relationship of the Mystic Ridge; the formation of the boulder concentration underneath the unsorted materials of the habitation area; and the suggested presence of man seen in deposits formed before the boulder concentration. Most challenging of all, of course, is the problem of the glacial origins of the unsorted deposits.

In the habitation area, the top 6 inches (Figure 1A, a & b) can be dismissed as a geological problem, since the activities of man are clearly responsible for most of the debris and accumulation of soil. Our concern here is with the origins of the underlying deposits (Figure 1A and Table 1: c, d & e). "Whatever the process, it has been halted since the occurrence of projectile points at the 6-inch levels" (Lee, 1954, p. 110).

The sorted materials between 27 and 24 inches (e) show no wind action. They appear to be "too well sorted, too angular, to be hillside wash. Probably they were deposited by small meltwater streams" (Dr. V. K. Prest, personal communication). The presence of finished artifacts and thin man-made flakes within them poses an interesting problem; the flakes are too sharp to have been tumbled or rolled very far.

Agreement has not been reached in explaining the deposits extending from 27 inches to bedrock (f-k). Sanford (Lee, 1954, p. 106) has described them as "lake deposits." Others believed that they were till. The alternating layers of light and dark materials at 4-feet depth were probably water deposited. Distortion and partial destruction or reworking may have followed with glacial action. Similar but undistorted deposits (Figure 9) were found in another trench nearby. The laminated structure was emphasized by the discovery of the vein tracings of what may have been a maple leaf.

The heavy boulder concentration (Figure 7) on top of the clays (f) may mean that the site was under water at this point and subjected to forces which left the boulders at one level while removing most of the finer materials. Another possibility, suggested by Dr. Sanford, is rafting close to an ice front. Pebbles and boulders which are faceted and striated strengthen this view. Although boulders and cobbles are normally most frequent in the top part of a till bed (Lundqvist, 1951, p. 32), the unbroken stratification of the underlying clays (f & g) and the hard-packed condition of sands directly under the boulders show that the boulders were not derived from the lower deposits.

The principal difficulty is in the identification of the deposits (c & d) between the sorted layer (e) and the projectile point level (b). Sanford (Lee, 1954, p. 106) and many other geologists have stated that the deposits would definitely be called glacial till were it not for the presence of artifacts within them. This has been the reaction of almost all visiting geologists.

Among the indications which point to till are the lenses of fine gravels and sands observed in the lower half of the deposits (d). Such lenses are typical of till (Lundqvist, 1951, p. 32, 56). He states that they are usually small but can be 3 by several feet across and that the materials are very clean and well sorted.

Could solifluction account for the deposits and the incorporation of artifacts? Under conditions of soil creep, it is conceivable that artifacts lying on the surface of till might become embedded and scattered. Are the conditions at Sheguiandah suitable for such movements? "Washburn (1947, p. 88-96) . . . regards a slope of about 5° or more as necessary to bring about significant downslope movement" (Schafer, 1949, p. 163). No such slope exists in the habitation area. Higher areas do rise to the north, but low, sharp, transverse ridges of quartzite and schistose bedrock lie squarely across the path of any proposed downslope movements. Certainly the piles of quarry rubble lying right up to the faces of quarries on the ridges show that no significant creep has occurred since the quarries were abandoned, at least.

What of the deposits themselves? They do not correspond at all to the descriptions of solifluction deposits by Bryan (1946, p. 626) and Smith (1949, p. 203). An adequate explanation must also include the evidence in the Middle Quarry area near the high point of the hill, where unsorted artifact-bearing deposits are perched on top of a ridge. There is no place from which soil could have crept, unless we can conceive of its crossing a swamp and climbing a ridge.

It is perhaps significant that no visiting geologist has considered solifluction movements from the higher areas available as anything more than a minor factor in the accumulation of the unsorted materials in the habitation area.

If the deposits are till, we have to consider an advance or oscillation of ice as a possible explanation for the presence of artifacts within them. The deposits are thin, but this appears to be characteristic of most of the till deposits on Manitoulin Island. The shape of the hill would protect the habitation area from severe erosion, while a suitable dumping ground would be provided by the trough between the Mystic Ridge on the south and the quartzite ridges on the north.

The artifacts, although usually broken, are not severely ground, battered or smashed; edges are often sharp; fragments of charcoal are present; bits and sometimes large blocks of shale are included; much of the material is local (quartzite, shale and schist); many of the stones, particularly greenstone, bear striae, many are faceted in the manner observed in glacial deposits south of Sudbury; pockets of clean sand are believed to have been brought in as frozen lumps; the deposits therefore could not have come very far, unless in the form of a frozen mass, nor could they have been extensively tumbled. The materials may have been picked up on the hill and merely moved to another part of it.

The proposed advance or advances must have taken place *before* Lake Algonquin. Nearby Algonquin beaches have not been destroyed. There are no adjacent high mountains to support lingering glaciers.

If the unsorted deposits are till, two principal actions are possible. One involves a bulldozer-like action, a shoving and tumbling, such as occurred at Wanapitei near Sudbury (Prest, 1949, p. 5, 6). This could only apply as a very local action on the site. Camp refuse would have been pushed forward a short distance on the hilltop. Another possibility is that the artifacts were picked up either on the hill or at some more distant point, incorporated in the ice sheet and transported. The materials could then have been dropped either by a retreating glacier or from the roof of an ice cave (Antevs, personal communication).

How else might the artifacts have been buried? "Tree-plowing" (Dietz, 1955, p. 273) cannot have affected a large percentage of the deposits, since the projectile points obtained from all squares have been found consistently under large bifaces and at about the same depth, even in the case of broken points, where the parts were widely scattered.

Aside from minor factors, such as rodent activity, the digging of pits by Indians, and the slumping when roots and stumps decay, there is the question of frost action. This can operate in several ways: differential freezing and movements (Schafer, 1949, p. 162 and Bryan, 1946, p. 633); needle or brush ice (Antevs, 1949, p. 233, 234); involutions (Schafer, 1949, p. 156, 158, 162); and upfreezing of stones (Richmond, 1949, p. 148).

Suggestions have been made by a number of authorities that the artifacts wormed their way down into the till. This would be more acceptable if it were not argued at the same time that all other stones were being heaved upward by frost. This worming action, if applied here, should be applicable to other Early Man sites within frost zones. The resulting effects upon dating are at once apparent. Stratification, of course, would preclude this.

To what extent has frost action been effective in churning up the unsorted deposits? Schafer (1949, p. 162) has stated that "the expansion of freezing interstitial water in porous materials is quantitatively insufficient to produce excessive frost heaving." In the heaviest rains, water did not stand or accumulate in our trenches at this level. No concentration of coarse fragments at the surface of the unsorted deposits (Figures 6-10) has been observed by the writer; indeed, the opposite is true. None of the frost-caused earthforms in heterogeneous material outlined by Antevs (1949, p. 233) such as stone rings, stone nets, stone stripes and earth stripes, has been observed here. Although a very few frost-fractured rocks have been seen in the excavations, many large, easily split blocks of laminated shales (Figure 7) and blocks of quartzite with weak jointing and bedding planes were unaffected beside them. In marked contrast, the north face of the hill is littered with frost-fractured blocks of quartzite, breaking down under modern winter conditions.

If frost action has been churning the unsorted deposits, it is difficult to see why the artifact assemblages are not thoroughly mixed. The occurrence of projectile points at about the 6-inch level shows that churning did not take place after they were put there. Frost churning cannot account for superimposed assemblages typologically and quantitatively different, within the unsorted deposits. The occurrence of undisturbed horizontal lenses of fine gravels and sands in the lower half of the till deposits, sometimes with artifacts directly under them, is conclusive evidence that frost action did not seriously affect the lower beds.

An important aspect of the question of glacial origins of certain deposits is found in the peculiar positions of swamps and their relations to the topography (Figure 2). It is seen that swamps 2, 3, and 4 are perched on the brink of the steep north face of the hill; also, that they are only 16 feet below the highest point of the hill, which is 737 feet above sea level. These circumstances result in a remarkably small catch basin for the swamps, the limits of which are indicated in Figure 2 by a dotted line.

Extending westward from Swamp 3, also along the lip of the hill, is a westward-sloping ravine with steep sides of quartzite. It emerges on the west brow of the hill (Lee, 1954, Figure 33), where a bar-like formation lies across the mouth. During heavy fall rains, water accumulates behind the bar. A trench was dug on its crest to determine its nature and origin. Artifacts were numerous in the upper 6 inches, which had been disturbed by plowing long ago. However, man-made chips and a few finished artifacts occurred to a depth of at least 16 inches through increasingly coarse gravels, cobbles, and quartzite blocks. All digging below this level was performed by geologists. Tumbled cobbles and some blocks of black shale up to 25 inches in diameter were encountered. The materials appeared to be stream-deposited, with a minimum of sand. It was concluded that they were put there by a heavy rush of water, sufficient to strip the shale and tumble it along. It is apparent in Figure 2 that no such volume of water could come from the present run-off area. The only possible source would be from ice, which must have filled the present valley to the north.

The deposits below the peat in Swamp 3 (Figure 1B) have been called outwash and till by geologists on the spot. The gravels are very sharp. However, Terasmae's pollen curves (Figure 3) indicate that the upper clays, at least, are not directly deposited till. The contained cores and chips may have been tossed from the slightly higher ridge, becoming embedded in previous sediments. (Note, however, that no signs of quarrying have been observed on this ridge). From the time when peat began to form, the swamps were never again invaded by lake waters (Figure 12).

Fall rains filled the swamps to overflowing. It was seen that an additional rise of about 24 inches would be necessary to bring about drainage to the west through the ravine. Instead, the water drained east through Swamp 2, across a narrow and level shelf of quartzite, thence sharply down the steep north face of the hill. What caused the reversal? A dam of till or other material, since removed, seems unlikely on this narrow sidehill perch, unless we may suppose that the melting back of glacial ice freed the new outlet.

THE OLDER ARTIFACT ASSEMBLAGES

Level III. Projectile Points. The cultural relationships of materials above the unsorted deposits in the habitation area have been discussed in earlier reports. However, some consideration will be given here to the projectile points found in 1954, since some of them suggest rather early connections. Although they occur at about the same depth, on top of the glacial deposits but underneath the large bifaces of Level II, it is difficult to consider them as a single component. Such relationships as can be recognized in terms of typology indicate wide separation in time. It is significant that similar points showing Laurentian characteristics occur all across southern Ontario, while the typologically earlier points are absent there but occur across the prairies to the west. In Figure 4, Numbers 1-5 exhibit Laurentian features. Heavy edge grinding is common to all of these except No. 2.

No. 6 is probably the tip of an unfinished projectile point, although it could be a knife or other implement. It was found in the peat beds of Swamp 1.

No. 7 is probably a projectile point which was made from a large lamellar flake. Attempts were made to thin the base, a feature which favors the view that this was not a knife.

No. 8 is a lanceolate form which has a fairly wide distribution (Mayer-Oakes 1951, p. 321) and appears in many early horizons. Similar points are numerous in the McKillop collection from the Regina area of Saskatchewan, now in the Royal Ontario Museum of Archaeology, Toronto. Similar points are illustrated in Stubbs (1950, Figure 4: 13, Missouri), Cressman (1947, Plate XVI-B:b, Oregon), and Haury (1950, Figure 54:c, from the midden of Ventana Cave). All are apparently associated with fairly early materials. Dr. F. H. H.

Roberts, Jr., found a similar point in eastern Wyoming which "should be from 5000-6000 years old" (personal communication). Giddings (1951, Figure 60b:2) shows a slightly larger point which was ground and basally thinned. One of the points from McGregor's Chrisman site (1954, Figure 17A, Illinois) is essentially like our No. 8. Considerable resemblance is seen to Melgaard's Figure 76:9 (1952) from Greenland, which is shown with a knife-like implement (Figure 76:12) closely resembling a Sheguiandah knife (Lee, 1955, Figure 32:14).

No. 9 is a basal portion of a blade which may have been like the Long point (now Angostura) of South Dakota and Wyoming. The chipping is not as fine, probably due to the quartzite. In outline the base is like those illustrated by Mulloy (1943: 4, 5, Yellowstone). Mayer-Oakes (1951, Figure 101: 18) shows a base which appears to be identical.

No. 10, although only a tip, has value in its resemblance to No. 4 (Lee, 1954, Figure 35). Both points are diamond shaped in cross section toward the tips. The resemblance of the nearly complete point to Scottsbluff has been noted by several authorities. D. Wenner (personal communication) has noted its resemblance to a point in the Denbigh Flint Complex (Giddings, 1951, Figure 60b: 1). Its weak-shoulders are characteristic of many points observed in Saskatchewan collections.

An incomplete point, No. 12, was found in two pieces, horizontally separated by several feet. Its indented base has led some authorities to call it Plainview; others regard the corner projections as genuine ears typical of many eastern fluted points. Three short channel flakes on one side suggest the eastern "triple flake pattern, in which two preliminary channel flakes were drawn and then the final channel flake drawn between them." (Witthoft, 1952, p. 481). Dr. B. McCary, on the basis of the illustration, has stated that the point is either an unfinished eastern fluted point or a rather roughly finished eastern fluted point (personal communication). He adds that the Williamson site, Virginia, has produced quite a number of basal ends which lack the final touches such as carefully prepared ears and well-smoothed extremities. This may indicate that such points were broken just before the final stage. In outline, No. 12 is like a Red Smoke, Nebraska, point (Davis, 1953, Figure 133a), although the ears of the Sheguiandah specimen seem much more pronounced. Similar outlines are seen in Howard (1943, Plate VIIIc, Folsom site), and McCary (1951, a fluted point site, Virginia). Jenks (1937, p. 39) noted that the Folsom point is commonly broadest above the midline. In this respect, our point corresponds to Folsom, rather than Plainview. The fluting is indefinite, but McCary (1951, p. 13) states that on some points from the Williamson site, the flutes are very short; on others, only 2 or 3 short scars served for basal thinning.

Some doubts exist as to whether full fluting is possible in this granular quartzite. The flake scars on cores (Figure 4:2) favor the possibility; note, however, that nearly all such cores were apparently selected for their greater density. They have a glassy quality, unlike the material in this point.

No. 13 is remarkable for its relatively deep flake scars on a thin blade. The chipping seems distinctively 'Yuma', while more than ordinary attention was given to thinning the base. The nearest approach to its outline is seen in Wormington (1949, Figure 9, left, Dent, Colorado). However, it lacks even the "rudimentary grooves" of the Dent point. On the other hand, it is probably too thin for fluting.

No. 14 is a 5-inch point which was found in two parts at about the same depth and several feet apart. It appears to have western and northern connections. Its nearest parallel is seen in Rainey (1940, Figure 16, Alaska Campus). Other resemblances are seen in Mulloy (1943, Figure 28: 12, Yellowstone), in what is called a "typical stemmed Yuma;" (note also his No. 23, which is very much like a Sheguiandah point in Lee, 1954, Figure 35: 6); Stubbs (1950, Figure 4: 16, Missouri); Rainey (1939, Figure 9: 5, Alaska), which "closely approximates the Yuma type;" Cressman (1947, Plate XVI-B:h, Oregon); Howard (1939, Figure 2; note that shoulders are not square); Worthington (1949, Figure 13:5), a "variant Scottsbluff point;" and Hibben (1943, Figure 10b), a "Sandia Type II point," which bears an outline resemblance to the Sheguiandah point.

Level IV. Large thin bifaces. Occupation Level IV occurs in the upper half of the unsorted deposits. It is represented principally by thin bifaces. Despite their large size, these are characteristically ⅜ inch in thickness. Nearly all are broken. Many retain some portion of a large bulb of percussion at one end, suggesting that they were made from large flakes, rather than from 'cores' or 'blanks.' Secondary chipping is prominent, although unfinished specimens are not likely to show this feature. Excellent examples are seen in Figure 5: 5, 6 and 8, and in Lee (1954, Figure 36: 5, 7). In a stratigraphic occurrence, bifaces with secondary chipping were found in red clays which had spilled into an ancient quarry, HD 1, (Figure 11), buried later under the quarry rubble of occupation level II (Lee, 1954, p. 107).

An interesting feature of several bifaces (Figure 5: 5-8) is the curious shoulder produced at one end and usually on one side only. Some of the double-shouldered tools show unmistakable evidence of use as scrapers, presumably hafted. Perhaps the single shoulder, in many cases, was a hafting device. That hafting was employed is indicated by the shapes of specimens such as Numbers 13-15 in Figure 5.

We have had little success in relating materials in Level IV to assemblages or specimens elsewhere. Although a biface from GL 1, donated to the National Museum of Canada by E. F. Greenman (see Lee, 1954, Figure 34:3) has the characteristics of bifaces from this level at Sheguiandah, he writes (1948, p. 317) that there is some doubt as to the intentional nature of retouching at that site. Elsewhere in Ontario, only a few scattered bifaces of this type and of this quartzite have been found: one (in R.O.M.A.) from Parry Sound District, one from Manitowaning on Manitoulin Island, and 2 from the base of the Bruce Peninsula. Some resemblance is seen to Nebraska specimens in Davis (1953, Figure 134, g).

A few cutting and scraping tools have been found in Level IV. Two examples (Figure 5: 3, 9) show fine cutting edges resulting from the removal of small flakes from both sides of one edge. No. 9 was evidently made on a broken biface, as is indicated by the general shape and the thinning toward the cutting edge. Numerous hammer marks across the broken end suggest that an attempt was made to strike useful flakes from this 'core,' with its ready platform. Some flake scrapers occur in this level.

Level V. Small thick bifaces. Occupation Level V is very poorly represented by a few thick bifaces and some flake scrapers. They occur in the lower half of the unsorted deposits. Man-made flakes are also relatively scarce in this zone. The bifaces to date do not exceed 3½ inches in length. No positive relationships to other sites can be determined on present evidence. Examples are seen in Figure 5: 10-12.

SPECULATIONS

As work continues on the Sheguiandah problem and a vast body of data accumulates, our growing conviction is that the full implications of the evidence are only beginning to be appreciated. Inevitably, in consultation with dozens of authorities, differences of opinion arise. Our policy has been to test every theory advanced, in terms of *all* of the evidence. "Objectivity is an absolutely essential attitude of mind if one is to have even a reasonable chance of correctly evaluating new scientific evidence" (Simpson 1954, p. 174).

Of all the new suggestions advanced, perhaps the most interesting and valuable is the strongly supported view of Dr. John Sanford (Lee, 1955, p. 70) that a readvance of ice placed the unsorted deposits (Figure 1A, c, d) and the included artifacts in their present positions. It is our belief that the peculiar topography of the site provided adequate protection from most of the destructive forces of glacial activity. The direction of ice movement was from east to west 5° north or 275° at this point, as shown by striae on the bedrock (Figure 8).

Dr. Sanford (Lee, 1955, p. 70) had originally considered a readvance of ice "since the principal glaciation." This recency cannot now be reconciled with the mounting evidence. With the waters of Lake Algonquin washing against the retreating Valders ice, the highest point of the Sheguiandah site became covered by some 280 feet of water, as the ice border withdrew from the place. It became dry land first during the final drainage of Lake Algonquin through the North Bay – Mattawa valley (Antevs, personal communication).

It was earlier suggested (Lee, 1955, p. 70) that small camps may have been situated along the ice front. However, if man first came to Sheguiandah after its emergence from the waters of Algonquin, the association of man and glacial ice would have occurred after the uncovering of Fossmill, 23 miles SE of North Bay, or more likely, of the Mattawa Valley. "There is no probability that the ice sheet returned to Sheguiandah during the Pembroke halt or after the emergence of the Sheguiandah knoll" (Antevs, personal communication).

After careful consideration of the suggestions and detailed examination of the evidence, it is our opinion that Indian activities, root and frost action, soil creep, viscous flow, and wash do not account for the unsorted materials or for the presence and condition of the artifacts within them. Beach action has been considered and rejected. The deposits appear to be glacial till in primary position. If this is correct, the embedded artifacts must be an original part of the till.

The slight disturbance of clays (Figure 1A:f) and the thin unsorted deposits (c & d) may indicate that the ice itself was light. However, for reasons not well understood, an ice sheet may erode in one place but not in another. Certainly something protected the easily destructible Mystic Ridge, which would certainly yield before any scooping out of the deposits in the habitation area could occur.

When could till have been deposited? Not by the Cochrane advance, since the ice then advanced only 23 to 40 miles south of Cochrane (Antevs, 1928, p. 149). Further, this advance is apparently recorded in forest changes on the peat profile of Swamp 3 (Figure 3, at 4-foot depth), all of which is post-Algonquin here.

The name Cochrane is often applied to the rebirth of glaciers a millenium or two before Christ (Krieger, 1955, p. 303). Many authorities, relying upon early C14 results, placed the advance at about 3,500 years ago. More recently, an improved analysis method shows that the advance was sometime prior to 6380 ± 350 B.P. (Rubin and Suess, 1955, p. 485, sample W-136). Dr. Antevs (1954, p. 520) places this event from 11,300 to 10,150 years ago.

We turn, then, to the earlier Valders. Several radiocarbon dates have been obtained in connection with this stage, from Two Creeks, Wisconsin. However, Antevs (1954, p. 519-520) challenges these and shows that "the C14 date of about 11,000 B.P. for the Valders maximum cannot be even approximately right. The Mattawa Valley may have become uncovered from the ice about 13,700 years ago, and the Valders maximum may have occurred roughly 19,000 years ago."

Early in our investigations (Lee, 1954, p. 111) an attempt was made to date the Sheguiandah site by the presence of curiously worn artifacts near the Nipissing notch. It was assumed, after Greenman (1943, p. 517), that wave-rolling on a beach was responsible for their condition. While Greenman has continued to date his George Lake site by this means (1955a, p. 2; 1955b, p. 376), the writer was forced to abandon wave action as an explanation at Sheguiandah, in view of the accumulating evidence against it there.

A brief consideration of lake levels is important to the understanding of the natural features and the cultural developments at Sheguiandah. The general view is that the waters of Algonquin were highest over the site as it was released by the retreating mass of the last ice sheet over this area. "Higher Algonquin beaches north of Sudbury indicate that the ice front was beyond that point before the land in question appeared above water" (L. J. Chapman, personal communication).

Algonquin waters were lowered in a series of drops recorded on the Manitoulin slopes by numerous well-defined beaches. The Sheguiandah site probably emerged first during the final drainage at North Bay. According to Quimby (1954), a reasonable dating of the maximum low-water stages would be from about 3500 B.C. to about 2000 B.C. This, of course, is in line with several published C14 dates. "As the facts and conditions are interpreted by Flint and associates (see Flint 1953, p. 917, plate 3) radiocarbon sample C-504 (3656 BP) would derive from a very late stage of Lake Algonquin, and C-608 (2619 BP) from the first stage of the Nipissing Great Lakes" (Antevs, 1954, p. 518). The writer has grave doubts about the accuracy and application of such dates; the possibilities of contamination of samples and the differences resulting from different methods of counting are considerable.

Some time after the hill at Sheguiandah was exposed by the lowering waters, early hunters arrived on the hilltop. "By 12,000 B.P. man could have spread from the Plains to Manitoulin Island by routes running either north or south of Lake Superior, and probably did" (Antevs, personal communication). J. N. Emerson (1954, p. 2) estimated that nearly 100 centuries have passed since the time when early man hunted and fished along the beaches of Manitoulin Island. Conditions encountered are not well known, but the occurrence of projectile points in very fine soil which we call 'transitional' (Figure 1A:b) may indicate that grass and forest covers were not sufficiently developed at that time to protect the surface from rain wash.

After the final drainage of Lake Algonquin at North Bay, land was more extensive than now in the Great Lakes country south of the pivot line from the North Bay outlet to Nipigon. At Sheguiandah the Lake Stanley shore stood 165 feet below modern Lake Huron. The Indians could have lived in large territories now drowned. All traces of man below the final Nipissing Great Lakes shoreline could have been shaved away by the rising lake (Antevs, personal communication). The crossings from Manitoulin Island to the Bruce Peninsula would have been much easier during the low water stages (see Hough, 1953, Figure 25, plate 102).

"The first (and only) 'Nipissing' stage came into existence at the level determined by the southern outlets." (Hough, 1953, p. 86). It lasted long enough to form one of the strongest beaches in the region. The waters then fell relatively rapidly to the Algoma beach, which occurs at Sheguiandah approximately 20 feet above the present Lake Huron level. It has been dated at 2619 ± 220 years (Libby, 1952, p. 674) from charcoal from the Burley site (Jury and Jury, 1952). No evidence has been found to suggest that the Indians remained here or used the hilltop in any way during the recession to the Algoma stage.

We have examined some of the evidence pointing to the presence of man in remote times and prior to the advance of the last ice sheet over the area. Is there anything to exclude this from the realm of possibilities? Conversely, is there any supporting evidence from other areas and investigators? Could man have been here in the times and conditions suggested?

In Wormington (1949, p. 152) we note that in Bryan's opinion a route of migration through the Canadian plains may have been open during periods of milder climate in the Wisconsin, once during the interstadial between the Iowan and the Tazewell-Cary, and again during the interstadial which separates the latter from the Mankato substage. Bryan believed that certain groups might have entered the continent during the last of these interstadials. Antevs, however, states that there was no oscillation of *long* duration just before the Valders (Mankato) glacial maximum at Milwaukee, but that several geologists believe there was a warm interval between the Tazewell and the Cary maxima (see Antevs, 1953, p. 216). By Trowbridge (1954, p. 794-795) this interval is estimated to have lasted 30,000 or more years. Antevs dates the beginning of the retreat from the Cary maximum at about 24,000 B.P. "Since Sheguiandah is located 350-400 miles from the extreme Cary moraine in Indiana and Ohio, the readvance from Sheguiandah to the moraine would have taken several thousand years. Therefore, the artifacts in the glacial till and gravel at Sheguiandah would be at least 30,000 years old." (Antevs, personal communication).

Several students of the subject believe that man was in the central parts of the continent 15,000 years ago. However, that was not a favorable time to spread here. Some 14,000 years ago the ice border may have stood at The Pas – Sioux Lookout – North Bay – Pembroke – Kazabazua; and prior to some 18,000 B.P. the road of entry was in all probability blocked by ice north of the Peace River. "The probable warm age of 25-40,000, or 25-55,000 years ago may have been a (the) natural age for the spread of man from Siberia via Alaska to the central regions of North America." (Antevs, personal communication).

Another approach, based upon an intimate knowledge of the pollen records, has been made by Dr. J. Terasmae. Since the artifacts found in deposits below the peat in Swamp 3 are older than any of those found in the peat, Terasmae would suggest that man invaded the Sheguiandah site probably in pre-Wisconsin time because the climatic conditions during any of the recognized Wisconsin interstadials would have been subarctic in the area and hence would have prevented invasion of the site by man. Suitable climatic conditions for such invasion were certainly present throughout the Sangamon interglacial and possibly also during the advance stages of the Wisconsin glaciation some 30,000 to 40,000 years ago.

It is seen, then, that the suggested antiquity (30,000 or more years) for the older cultural remains at Sheguiandah (Figure 1A, deposits c, d, e & f) is not unreasonable from a geological standpoint. Is it reasonable in terms of archaeological concepts and findings?

Clements (1954, p. 178) states that "evidences of Pleistocene cultures are being recognized in ever-increasing number over widespread desert regions of southern California." Recently a C14 date of "more than 23,800 years" for a site at Tule Springs, Nevada, was discussed by Harrington (1955, p. 554). Meighan (1955, p. 312), reporting on a paper by Ruth Simpson, adds that "the case for long Pleistocene human occupation of the New World is growing ever stronger. Man's New World age-potential becomes apparent as arbitrarily established age-ceilings are discarded, thus clearing the way for unbiased research." Dr. George Carter, who has in several papers revealed his findings and interpretations, wrote (1951, p. 306) that the early "lower Paleolithic" cultures in America "had little stonework, only simple flakes and cores." He feels (1950, p. 101) that the evidence suggests that man, possessed of only simple stone flakes, lived at La Jolla something like 40,000 years ago. Many authorities have argued that his Texas Street specimens are products of natural forces, rather than human handiwork. A few of these were examined by the writer at the Arizona State Museum, through the courtesy of E. B. Sayles, and some were accepted with confidence as products of human work. A strong case for them has been presented in detail by J. Witthoft (1955).

Simpson (in Meighan, 1955, p. 311) states that projectile points appeared late in Wisconsin times; before this it is believed that there was a widespread, simple cohesive lithic industry west of the Rockies, extending from Wyoming to Baja California, with these traits: primarily choppers, scrapers and similar tools; use of local material; percussion flaking; predominantly cores; no grinding tools or stone projectile points; tools heavily weathered and patinated.

Bryan (1950, p. 3) noted that approximations to stone types of the early Paleolithic exist in America. Hurt (in Wormington, 1949, p. 155) suggested that the earlier culture complexes reaching North America may have been characterized by percussion flaked choppers, scrapers, a blade tradition, and an absence of stone projectile points. His suggestions are in line with the findings on the "Pleistocene sites" of Clements (1954, p. 178), Simpson (in Meighan, 1955, p. 311), and Harrington (Tule Springs).

The Sheguiandah assemblages within the unsorted deposits are percussion flaked choppers, scrapers, bifaces, and cores. No projectile points have been found in the unsorted deposits. Ground stone has not been found anywhere on the hill. In stratigraphic occurrence above the early assemblages and unsorted deposits are projectile points which in turn are typologically the earliest known in Ontario sequences of projectile points. Every line of evidence points to great antiquity for the assemblages in the underlying unsorted deposits.

SUMMARY

Continued excavations at the Sheguiandah site on Manitoulin Island, Ontario, confirm the presence of at least five occupation levels, two of which are in unsorted deposits which are believed to be glacial till. Projectile points, the forms and flaking of which in themselves suggest considerable antiquity, occur above the till but below the humus layer. Further traces of man were found below the till; some of these are in what may be meltwater deposits; others occur under heavy boulders which form a 'paving' in certain areas. Four swamps on the site were explored and man-made objects were found under as much as 5 feet of peat. Pollen analysis of the peat suggests that the Cochrane glacial advance occurred during the accumulation of the peat, which began here, as shown by radiocarbon analysis, more than 9130 ± 250 years ago.

Various explanations for the unsorted artifact-bearing deposits have been considered, including tree plowing, root slumping, beach action, ice rafting, frost action, viscous flow, and soil creep. Although these factors may have been operative in a minor way, they do not explain the main body of the observed evidence. The suggestion of glacial till, on the other hand, is favored and supported by the nature of the deposits and their peculiar position on the site; the faceted stones, many of which are striated; the distribution and condition of encased artifacts; the occurrence of sand 'lumps;' and the presence of certain horizontal lenses of sorted sands, which are typical of till.

If the unsorted deposits are glacial till, they must predate Lake Algonquin and would probably have been left by the Valders ice. The artifacts would be still older, possibly of the Cary-Tazewell interstadial, possibly much earlier, whenever conditions were suitable for the advent of man and occupancy of the site. If so, '30,000 years' may be a very conservative estimate for the older components of the Sheguiandah site.

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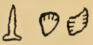
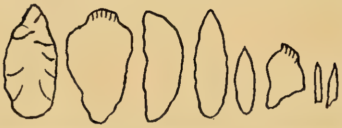
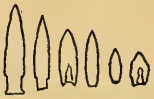
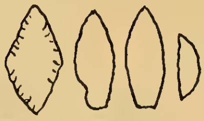
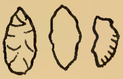
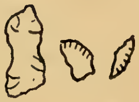
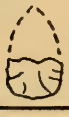
Table I. STRATIGRAPHY OF THE SHEGUIANDAH SITE, HABITATION AREA.

ZONE	SOIL	OCCUPATION	TYPICAL ARTIFACTS	CULTURAL RELATIONS
Surface		Level I		Scanty traces of Point Peninsula. No pottery.
a	0 - 6 inches Humus.	Level II		Large primary-flaked bifaces. Cutting, scraping, graving tools. Lamellar flakes. Relations: GL I and Giant sites.
b	6 - 7 inches Transitional, buff colour, fine soil.	Level III		Projectile points and drills. Relations: Archaic and Early Man.
c	7 - 14 inches Unsorted.	Level IV		Large, thin, secondary-flaked bifaces, usually broken. Scrapers and utilized flakes. Relations: none known.
d	14 - 24 inches Unsorted, contains sand lenses.	Level V		Small crude bifaces, a few scrapers. Relations: none known.
e	24 - 27 inches Sorted.	?		One notched biface, several scrapers. Relations: none known.
f	27 - 36 inches Silty clays.	?		One broken biface, several battered objects and flakes believed made by man.
g,h	36 - 50 inches Silty clays.			No trace of man found.
i-k	50-86 inches Silty, partly laminated.			No trace of man found.
	quartzite bedrock.			

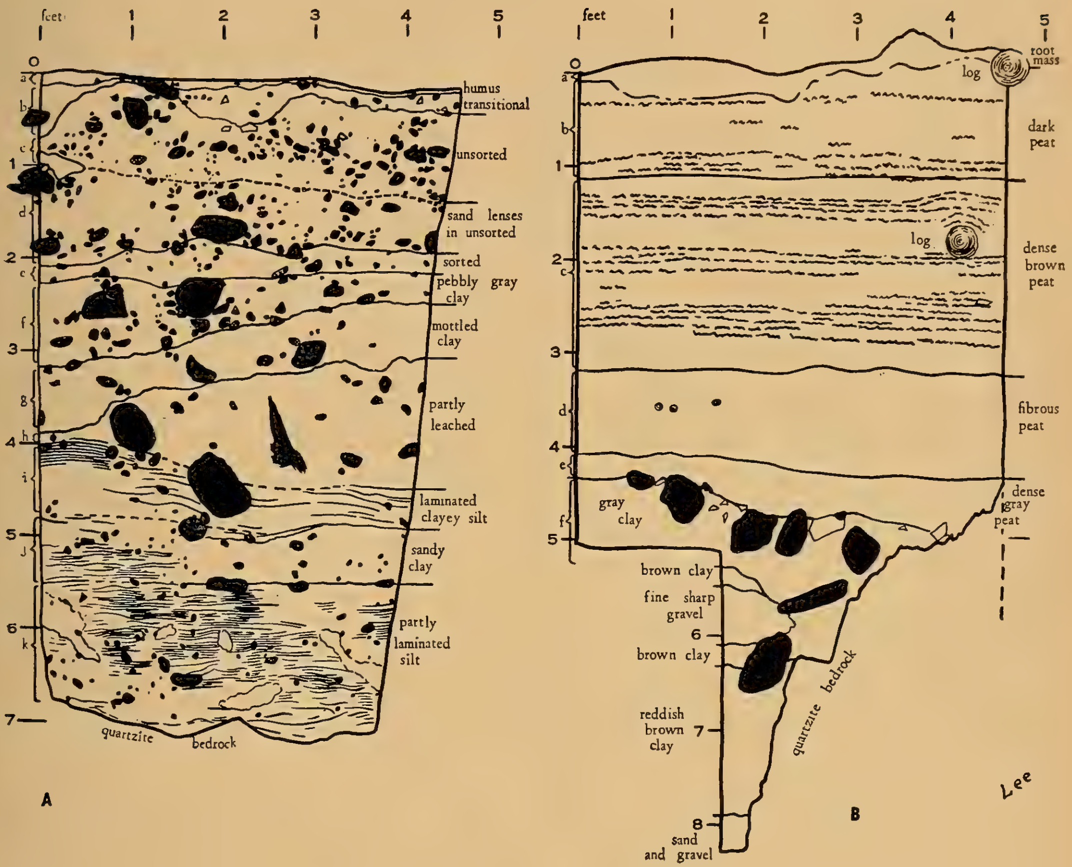


FIGURE 1

A. Sheguiandah site. Profile of test pit to bedrock in habitation area, Station 7-8. Artifacts of at least five cultures and periods occur from the surface to layer f at 30 inches, in or beneath glacial deposits from c to f. Stones other than artifacts are shown in black or (shale) with hatching. Note alternate dark-light layers at 4 feet.

B. Profile of test trench in Swamp 3. Early Man stone chippings and cores occur under 5 feet of peat and are older by an unknown amount than the basal peat, which has been dated by radiocarbon at 9130 ± 250 years. A cold period is indicated in layer d, from 38-50 inches, by pollen changes; this may correlate with the Cochrane glacial advance. Numerous charcoal layers above 3 feet may represent forest fires.

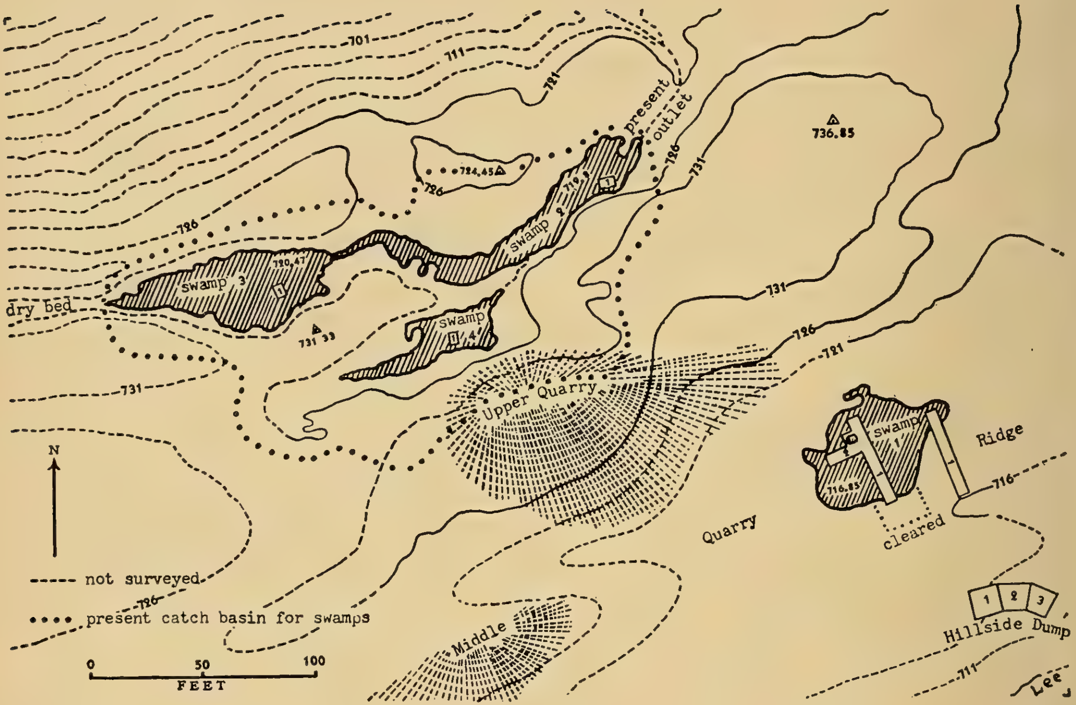


FIGURE 2. Sheguiandah site. Swamps near the highest point. Artifacts occur under peat in all four. The drainage of Swamps 2, 3 and 4 has been reversed from west to northeast. Insufficient run-off area, as enclosed by dotted line, exists around the swamps to account for deposits at the mouth of the former drainage outlet to the west.

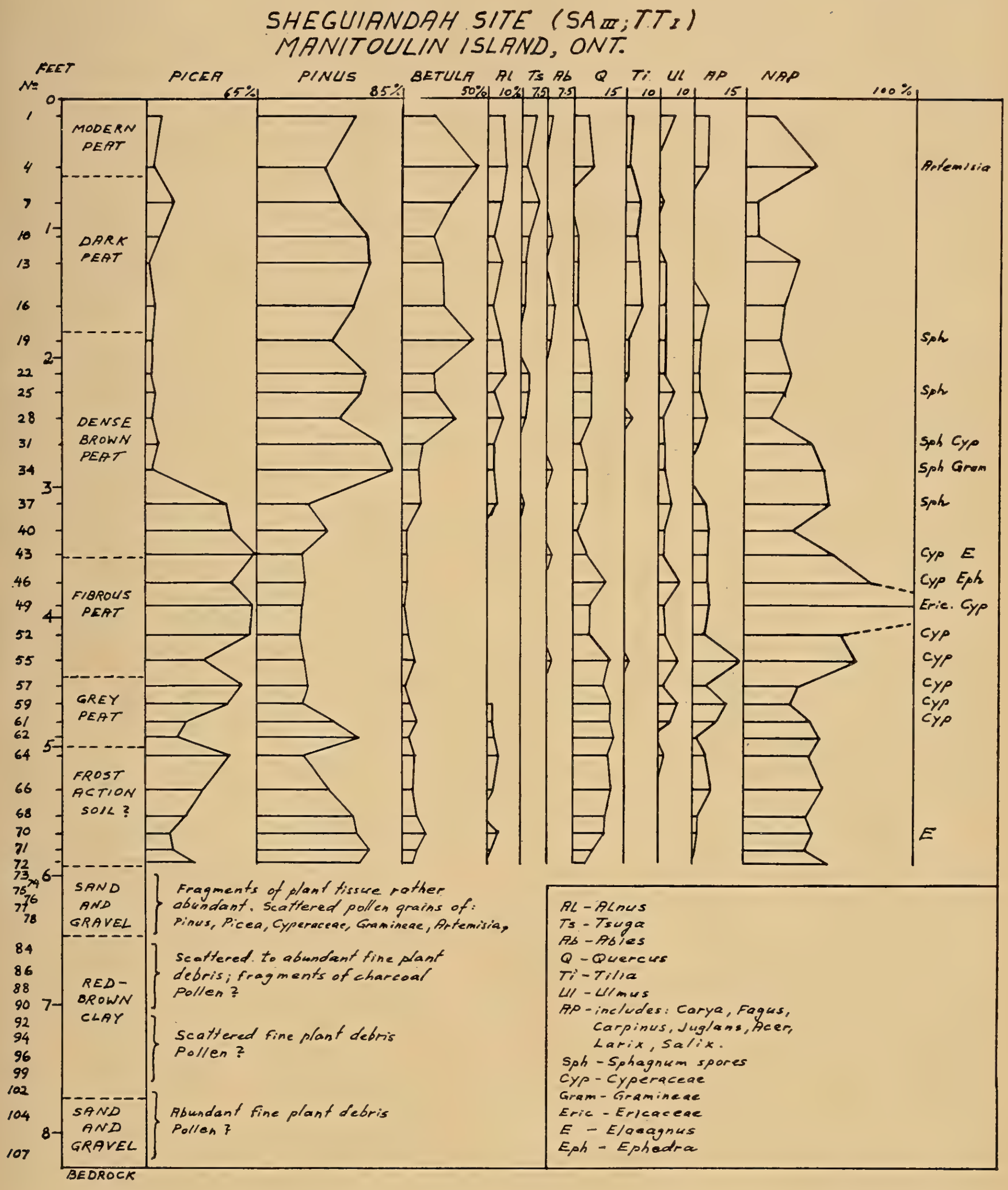


FIGURE 3. The pollen record in Swamp 3, by Dr. J. Terasmae. Note the decrease in pine and the increase in spruce and nonarboreal pollen, centering in the fibrous peat at 4-foot depth. This represents a cold period and may correlate with the Cochrane advance of ice. Irregularities above this point may be due to forest fires.

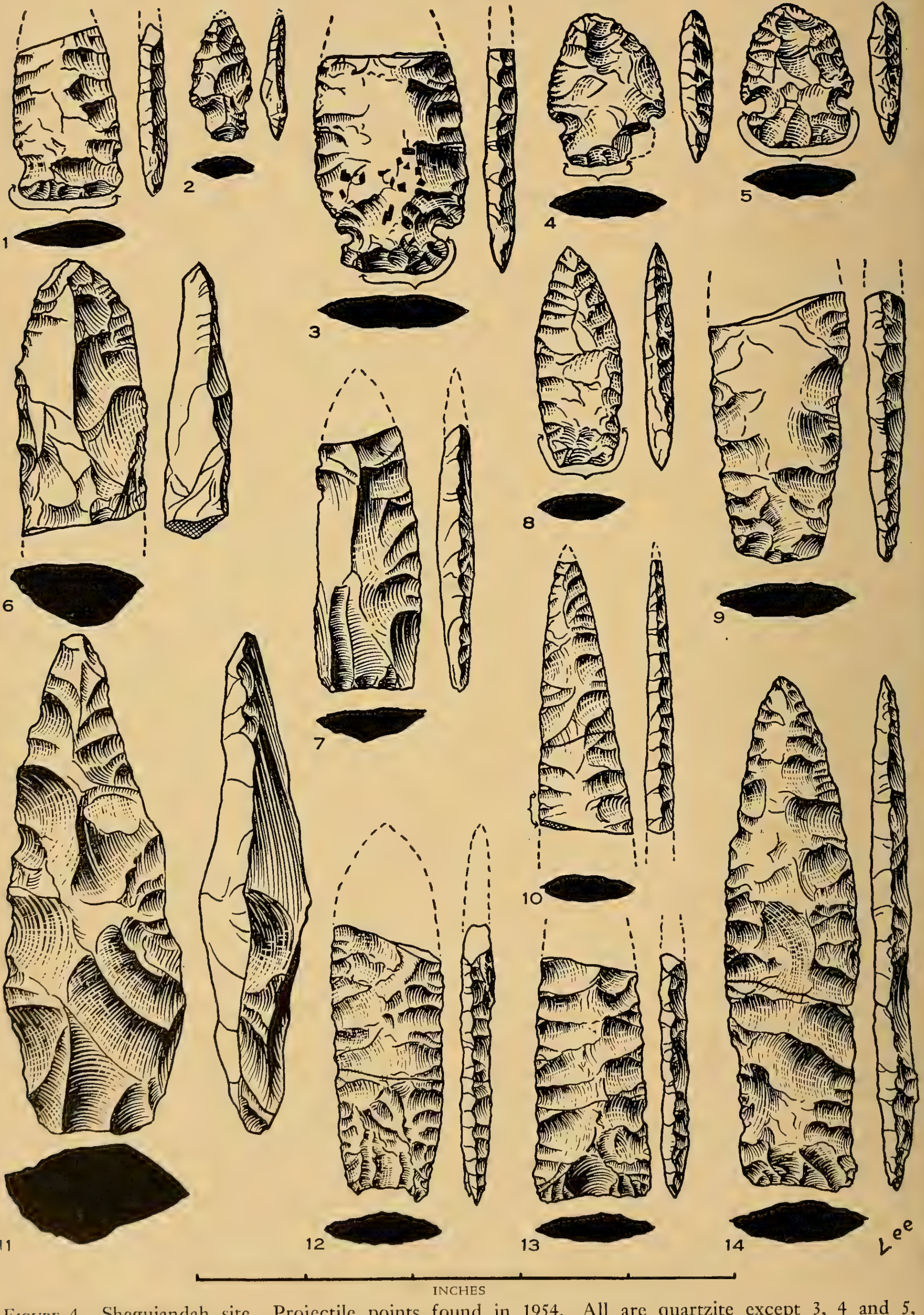


FIGURE 4. Sheguiandah site. Projectile points found in 1954. All are quartzite except 3, 4 and 5, which are chert. Edge grinding is indicated by brackets. Numbers 1-5 have Laurentian characteristics. Numbers 6 and 11 are unfinished. No. 7 was made from a lamellar flake. No. 8 is Archaic. Numbers 9, 10 and 12-14 are Early Man points and suggest western or northern connections. All but 2, 6, 7 and 11 are from Level III.

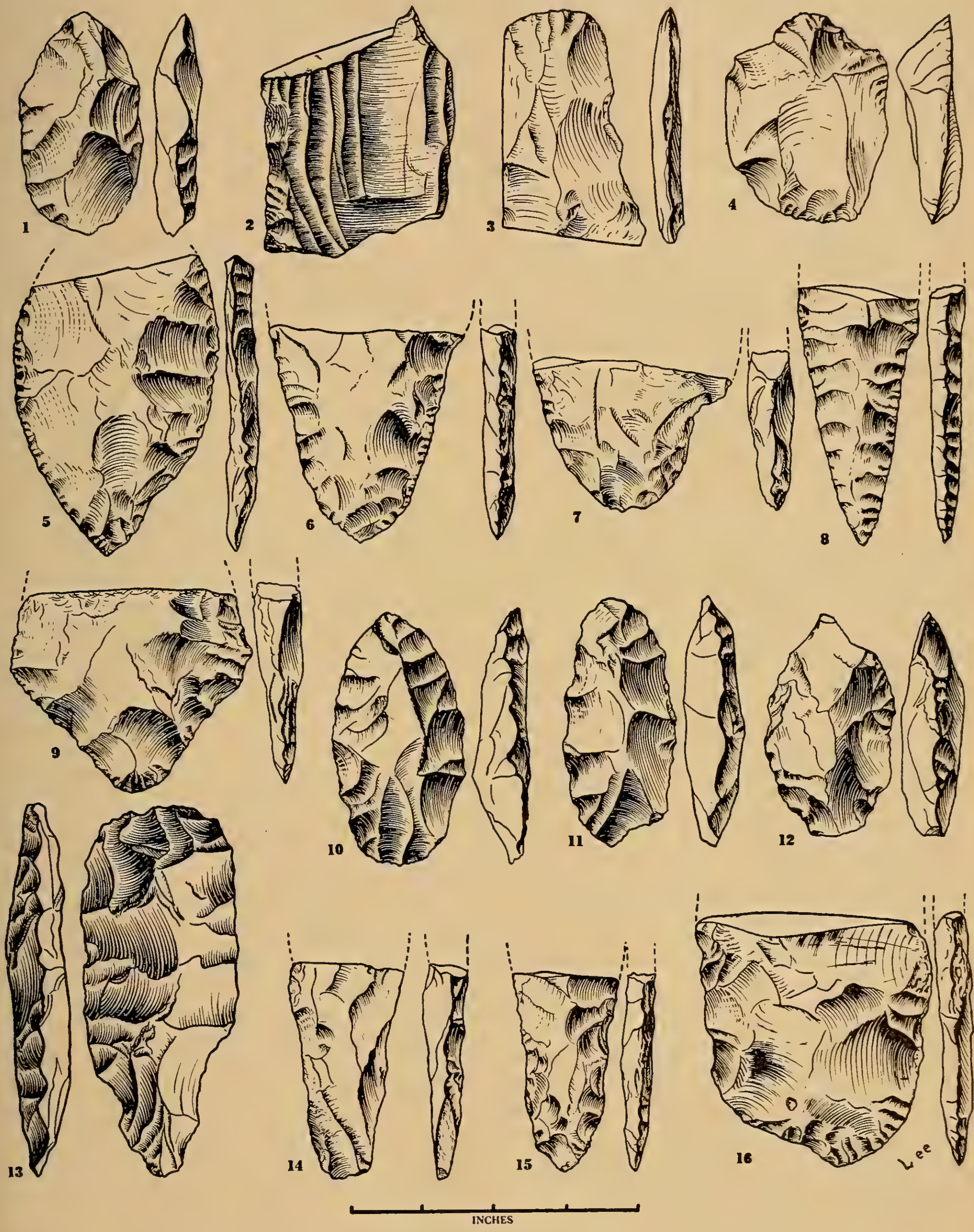
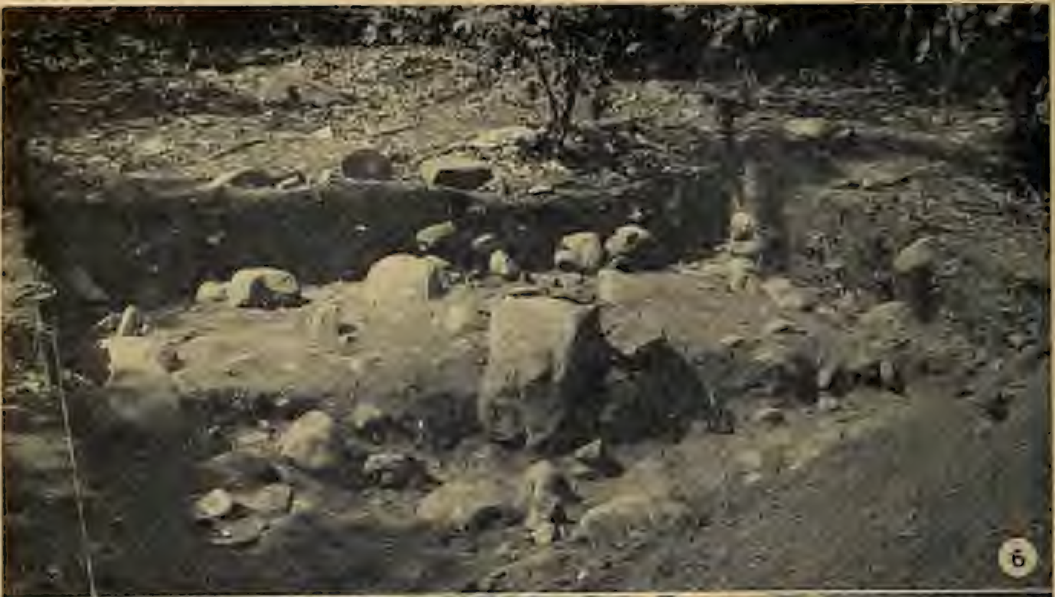


FIGURE 5. Sheguiandah site. Tools. All are quartzite except No. 1 (porphyry) and No. 16 (slate). No. 2 is a glassy quartzite core, bearing lamellar flake scars. Numbers 3 and 9 are cutting tools; an attempt was made on the latter after breakage to strike off flakes, as from a core. Numbers 5-8 are 'single shoulder' bifaces from Level IV; note secondary chipping on 5, 6 and 8. Numbers 10-12 represent Level V. Numbers 13-15 may have been hafted (13 is from the Giant site).



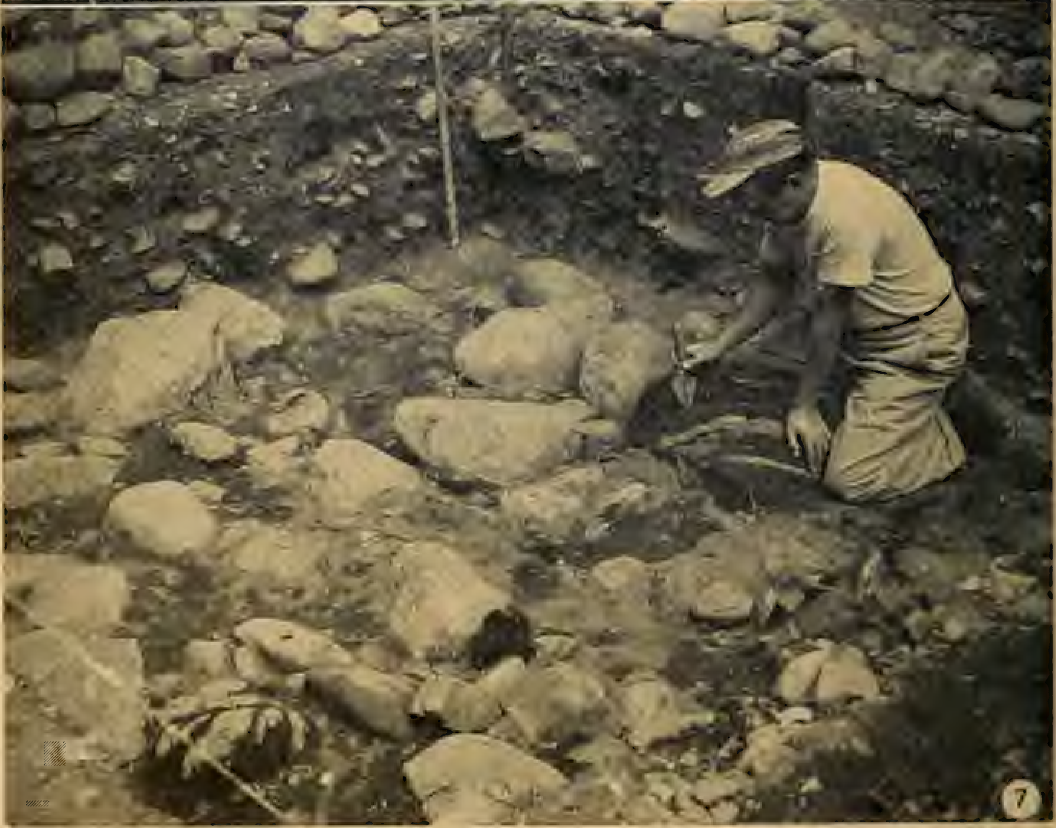
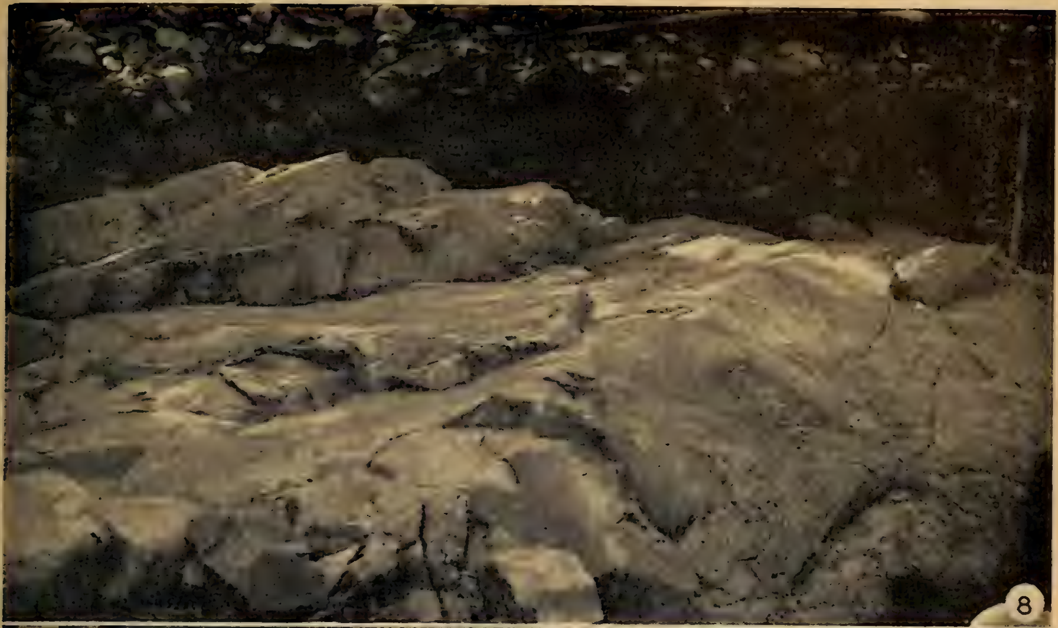


FIGURE 6. Sheguiandah site, habitation area, Station 7-1. Cobbles and boulders occur at all levels in the till deposits, with artifacts among and under them.

FIGURE 7. Habitation area, Station 7-9. Foreman Walter Kenyon examines a large shale block forming part of boulder paving. Artifacts occur among and under these boulders, overlain by till deposits.



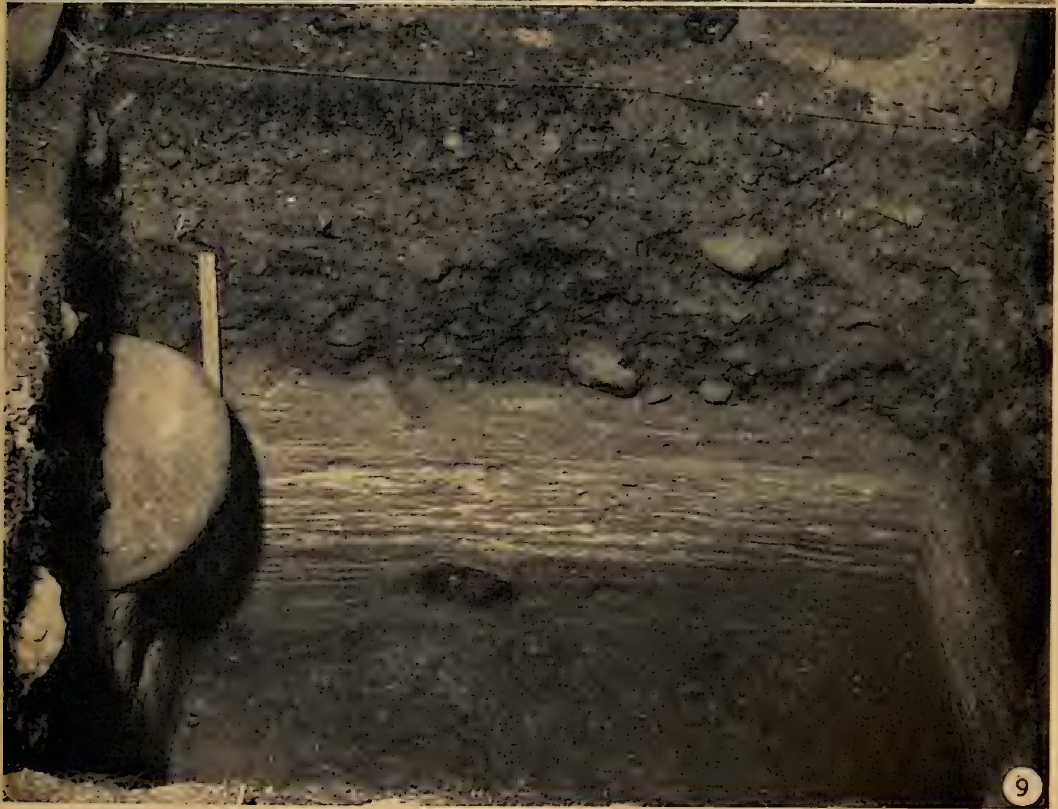
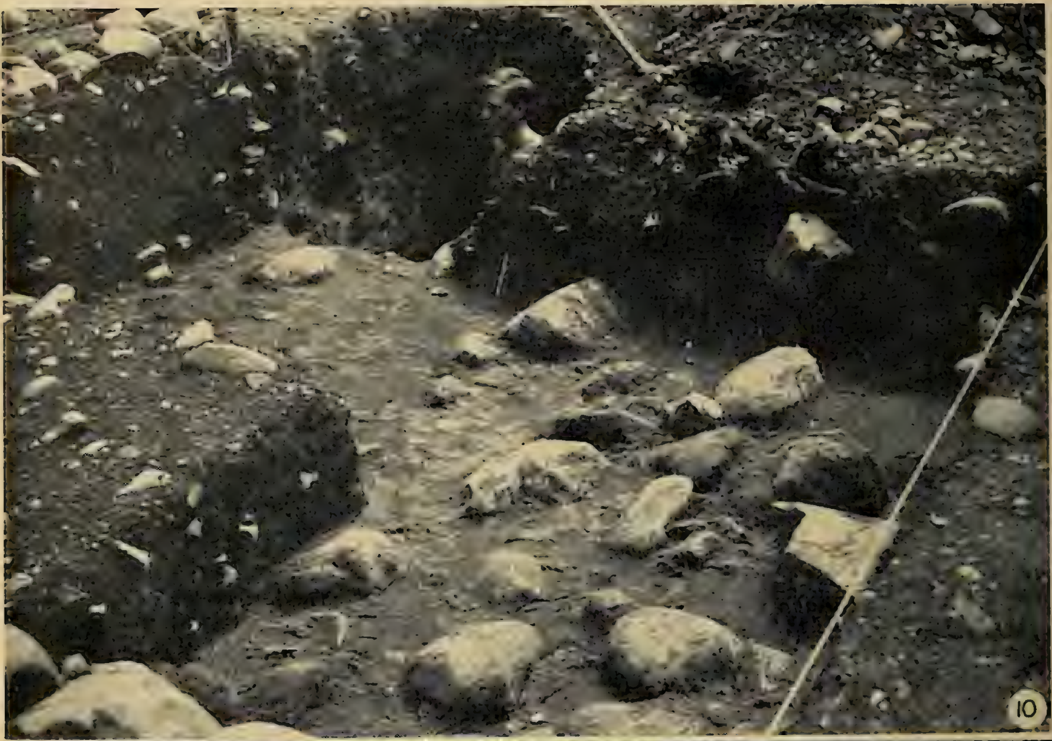


FIGURE 8. Sheguiandah site, habitation area, Station 7-11. Quartzite bedrock exposed by removal of overlying till. Note results of glacial plucking, left rear, with Indian quarrying in the fore. Ice movements were from E. to W. 5°N.; striae are well defined at the right.

FIGURE 9. Habitation area, Station 8-B. Laminated silty deposits, alternating light-dark, rest on quartzite bedrock, under till deposits.



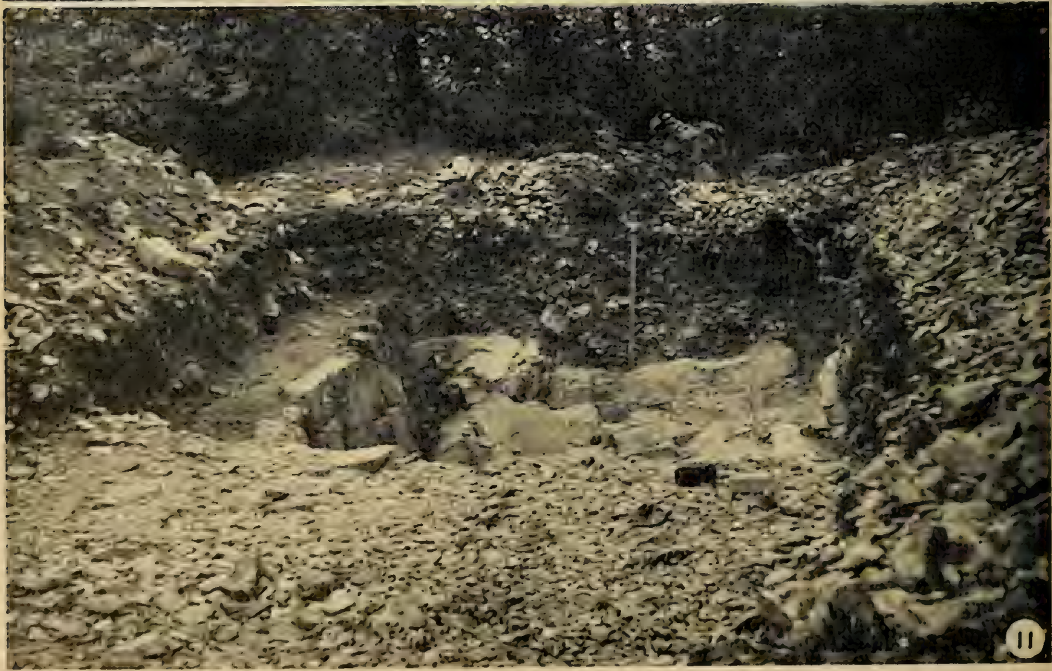


FIGURE 10. Sheguiandah site, habitation area, Station 7-9. Artifacts were left in situ in shelf of lower till at left, until examined by several geologists. Note fine meltwater deposits among boulders, right, at 30-inch depth.

FIGURE 11. Hillside Dump I. Quarried bedrock is overlain by quarry debris from later Indian activities. String at left on far profile marks stratigraphy. Quarry was rectangular, 14 x 10 feet, and 3 feet deep in bedrock. Many such quarries exist on the site.

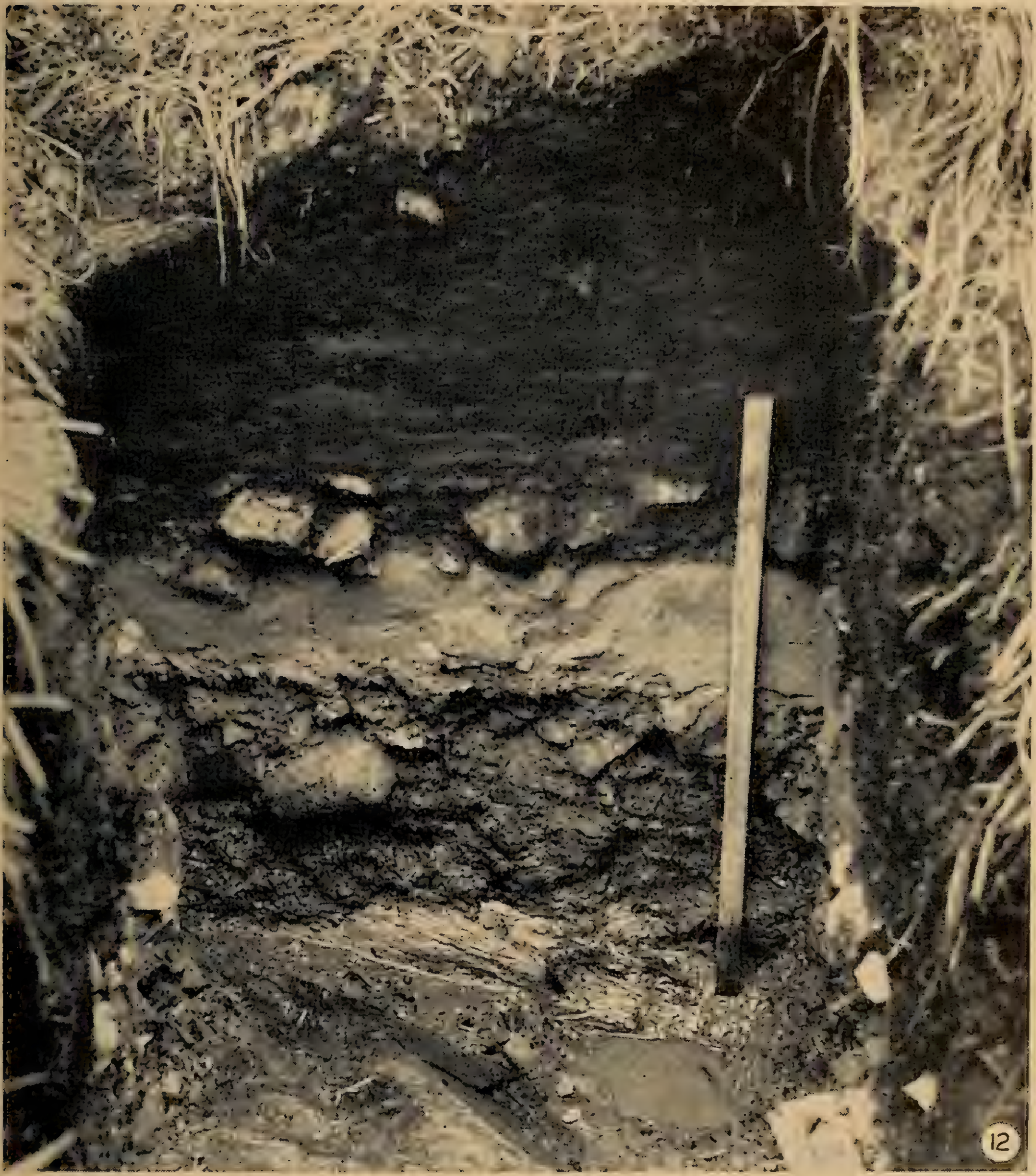


FIGURE 12. Sheguiandah site, Swamp 4. Artifacts occur in the peat, the sandy clay layer, and the underlying sharp gravels. Rejected cores can be seen projecting from the sides of the trench. Pollen analysis of the peat by Dr. Terasmae shows correlation with that in Swamp 3.

GEOLOGIC OBSERVATIONS AT THE SHEGUIANDAH SITE

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INTRODUCTION

THE SHEGUIANDAH site is located in the northeastern part of Manitoulin Island, Ontario. It is situated on a quartzite knob on the edge of the town of Sheguiandah which overlooks Sheguiandah Bay. Little Current, the principal town of the island, is about six miles north of the site. The crest of the quartzite hill is circled by the 625-foot contour line giving it an altitude of over 145 feet above the bay and North Channel whose surfaces are 580 feet above sea level. The top of Sheguiandah Hill, one mile to the north and slightly west, rises to slightly over 1000 feet above sea level and is the highest point in the immediate vicinity, although another hill approximately three-and-one-half miles to the west rises to over 1025 feet and still farther west hills of over 1100 feet occur.

The area is unique in many ways, both geologically and archaeologically. The geology will be summarized subsequently. The archaeology has been discussed in several papers by Lee (1953, 1954, 1955 and 1957). At least five, and possibly more, cultures are involved, several of which are associated with glacial sediments. The relationships are shown in Figure 1 which is greatly generalized. The sequence of unconsolidated sediments overlying the bedrock varies considerably, but the stratigraphy may be generalized as follows:

(1) Deposition of silts, clays and ice-rafted materials in a preglacial lake or lakes. These deposits contain a few finished artifacts and man-made flakes.

(2) Deposition of a thin layer of poorly sorted gravels and boulders near the margin of an approaching ice front, or possibly reworking of previous deposits to produce a thin boulder-gravel layer.

(3) Deposition of at least two thin layers of till, each with its own distinctive assemblage of artifacts (thin big bifaces in upper portion, small thick bifaces in the lower).

(4) Deposition of peat and other swamp deposits in depressions on north side of site.

(5) Modification of surface soils to a depth of six to eight inches. Organic agencies, including man, and weathering processes, a significant one of which was leaching, were responsible for this modification of these materials which were deposited as glacial till. The water-laid clays with boulders, underlying the swamp deposits, on the north side of the hill may or may not be contemporaneous with those of the habitation area.

During the summer of 1952 the writer had the privilege of visiting the Sheguiandah site for a period of some ten days and of observing the inch-by-inch excavation of the squares that had been opened during the first season's work. This work and that of the succeeding seasons has been carried on under the direction of Thomas E. Lee, of the National Museum of Canada, who discovered the site in 1951 (Lee, 1953). An examination of the excavation, under the guidance of Mr. Lee, and his discussion of the archaeological stratigraphy brought out very clearly that the interpretation of the site involved problems in both physical stratigraphy and sedimentology. Furthermore, there appeared to be the distinct possibility that considerable time was involved and that the stratigraphy of the late Pleistocene would have to be taken into consideration. As this is written, a fourth season of excavation, test-pitting, and trenching is approaching a close. Each season the writer has enjoyed the hospitality of Mr. Lee and his crew at the dig and has had the opportunity to examine the pits and the materials taken from them. He also had the pleasure in 1954 of an overall view of the materials from the site in the store rooms in the National Museum of Canada. Although his viewpoint on this material is that of a layman, it has served to round out the broad picture and point up the quantitative side of the archaeological findings.

The writer's approach has been primarily that of the sedimentologist and stratigrapher. As pointed out by Dr. Antevs (letter to Lee), there would be great advantage in correlating geologic events at the site with the regional Pleistocene and Recent history, but any comment of this character in this writing is necessarily of a very generalized nature, and any data regarding the regional chronology have been taken from the common literature or otherwise suggested by chronologists. To do more would necessitate considerable field work over a wide area and this must be left to the students of Pleistocene geology. The sediments and their relationships at the site have yielded an interesting set of observations which form the basis for these notes. There is always some danger in drawing conclusions from localized information, but there is perhaps an even greater hazard in failing to draw rather obvious conclusions from facts as seen in the field because they seem contrary to established thinking. In the early stages of the work there was some difficulty in overcoming this latter hazard. The site is radically different in many ways. However, with certain noted exceptions the evidence seen in the field to date points quite conclusively to the interpretations suggested here. It seems appropriate to summarize what is known of the geology.

The geological interpretation has borrowed liberally from the archaeological evidence as will be apparent from the discussion. The artifacts have been used to separate strata of till in the same manner in which any fossils might be used. These tills have physical differences which appear when they are carefully studied, but superficially they are very similar. Fortunately the artifacts have been collected with very detailed stratigraphic information, and Mr. Lee has most kindly made these data and his identification of the various cultural levels available for checking against the physical stratigraphy. Many discussions in the field with Mr. Lee and various members of his crew have served to bring out the problems involved and their intimate knowledge of the dig has been of much assistance in obtaining field data. It is hoped that the geologist's approach has been of some assistance to the principal purpose of the work. It is certain that the archaeological data have shed considerable light on the sequence of geological events, and that a proper chronology is dependent on the application of both disciplines.

The writer is indebted to Dr. Ernst Antevs for helpful suggestions and for reading and criticizing the manuscript. He also wishes to acknowledge the benefit derived from a field discussion with Dr. Jaan Terasmae, who likewise read the manuscript. A particular debt of gratitude is due Thomas E. Lee, who made the excavations available to me and who was most liberal with his field data and observations. Much of the interpretation has evolved as the result of discussion with Lee and members of his crew. He also read the manuscript and contributed significantly to its improvement.

GENERAL STRATIGRAPHY AND SEDIMENTOLOGY

The site is best understood if some brief reference is made to its more remote geological background. Almost the same topography that forms the backbone of the present setting influenced the character of the local early Paleozoic sediments, which in turn have added some detail to the present topography. The quartzite hill at Sheguiandah, the flanks of which are still covered with Ordovician sediments and which was protected by them for hundreds of thousands of years does not differ greatly from similar quartzite hills on the mainland which must have been exposed to erosion over much greater periods of time. This is a tribute to the quality and toughness of the quartzite, the quarrying of which was apparently the primary objective of the early inhabitants just as it is one of the principal occupations of the present population. Sheguiandah has apparently been the site for intermittent quarrying operations over a period of thousands of years. The waves of both the Nipissing Great Lakes and the Ordovician seas broke against the flanks of the Sheguiandah Hill as evidenced by the development of gravels, benches and wave-cut notches in the surficial deposits and by the dolomite-cemented boulder beds and pebbly dolomites whose pattern forms the basis for a topographic ridge, to be discussed later, which probably influenced the early occupations. The seas in which these basal beds were formed did not cover the tops of the hills as shown by the presence of the overlying Collingwood shales in contact with the quartzite where patches of it occur near an adjoining summit.

By the time Pleistocene ice had reached the knob at Sheguiandah its top had been stripped of sedimentary cover and some relatively low areas eroded out, probably in part localized by the occurrence of relatively soft schist in the quartzite. The lineation of the topography is certainly dependent on the general east-west strike of the nearly vertical quartzites.

The glaciers apparently did not erode deeply but polished the surface of the quartzite and left enough chatter marks and striations to show that the direction of ice movement, at least toward the close of glaciation, was influenced by the topography. The realization that major topographic features are largely due to preglacial erosion and areal geology has helped considerably in the interpretation. If there was a heavy cover of till resulting from earlier ice sheets, it was obliterated by the action of glacial lakes or interglacial erosion as many of the test pits show a sequence of proglacial lake clays and silts above the bed rock (Figure 6). Overlying some of these are thin deposits of till (Figure 2) which show what might be termed a glaciofluvial influence at their base. The upper few inches show some effects from weathering, human habitation and the usual accumulation of humic material which develops in a forested area at this latitude. In low places near the hilltop there is still some ponding in the spring and early summer and swamp deposits, rich in humic material, have accumulated.

The distribution of the artifacts is a vital part of the stratigraphy. The details have been described by Mr. Lee (1953, 1954, 1955), whose findings will be referred to subsequently, but evidence of human workmanship has been found in all deposits above the proglacial lake clays and silts and a few evidences of human workmanship have been obtained from these.

THE PREGLACIAL SURFACE

As stated in the introduction, it is the writer's opinion that most of the bed rock topography had been developed by Pleistocene time. The approximately east-west ravine on the north side of the hill was developed in schistose quartzite which was less resistant to erosion than the relatively pure quartzite comprising most of the hill. The hill shows no evidence of having been greatly altered by glaciation. The quartzite has been polished and chatter marked but the dolomitic conglomerate well up on its side has not been removed nor has all of the shale. A patch of shale on the summit of the hill to the north, currently quarried, would also seem to indicate that there had been relatively little modification of major features of the topography by the ice. The surface materials of the Mystic Ridge, discussed later in this paper, may be an even more conclusive evidence for this point of view.

A comparison of the quartzite hills near Sheguiandah with those on the mainland to the north brings out a striking fact. Although the latter, in all probability, had the benefit of much less protection from Paleozoic sediments, the major features of the two sets of hills are remarkably similar. It would seem that the topography as seen today must have been largely developed in Precambrian time, and that the quartzite has undergone very little modification since, excepting the scouring, polishing and the removal of surficial features by the ice. As far as Pleistocene and Recent history is concerned it seems necessary to assume a bed-rock background not greatly different from that of today.

THE LAKE DEPOSITS

In contact with the quartzite in some of the areas flanking the summit are varying thicknesses of deposits of a type sometimes referred to as lake clays, in this case a mixture of silt and clay, which may well have been deposited in a proglacial lake. The age, or ages, of these silt-clay mixtures is an extremely critical matter with respect to the whole chronology. These appear to be the oldest surficial deposits in the immediate area of investigation, and where seen in test pits (Figure 6) the quartzite which they overlie is well polished by glaciation. The greatest thicknesses measured are between four and five feet. The sediments are an intimate mixture of clay and silt, gray in color with rusty streaks and patches and contain quite a number of pebbles and boulders. Occasional artifacts have been found in the upper part (Lee, 1957). The pebbles and boulders stand out distinctly from the silt-clay mixture which is definitely a water-sorted material and in no way suggests till. This deposit might very well have been formed in a proglacial lake, far enough from the ice front that only silts and clays were water borne but close enough for floating ice to bring in boulders. In some cases the glacial origin of these boulders is shown by faceting and striations.

A freshly exposed surface has a fairly massive appearance except that the rusty streaks, although somewhat irregular, show an approximately horizontal lineation (Figure 2). Lee (personal communication) indicates that when excavated this material came out in layers and he feels that it might be considered to have a laminated structure. This structure would be consistent with the lacustrine origin postulated. The rusty coloration suggests surface weathering, a process which could not have taken place since deposition. It seems probable that the supply of sediment was derived from a melting ice mass which contained a mixture of weathered and unweathered material. Prominence of weathered material might be expected from a relatively lightly loaded glacier.

Since this lacustrine material is seen only in depressions in the bed rock, this type of sedimentation may have continued for only a relatively short time or similar materials may have been removed from the higher parts of the hill. The relationship of the age of this material to that of lake deposits seen in the pits farther down on the flanks of the hill is problematical, but pollen studies might shed some light on their correlation.

Since Lake Algonquin, whose shorelines can be seen on higher points on the island at elevations well above the hill at Sheguiandah, was the last body of water to submerge the site, it might be assumed that these lacustrine beds are Algonquin deposits. This was the original working hypothesis but there are a number of reasons why it seems untenable. The character of the sediments seems to indicate fairly close proximity to the ice front and quite a different set of conditions than have been postulated for Lake Algonquin time. The data are insufficient to determine the actual age of these beds at present. This will have to await the finding of further evidence or a better understanding of regional chronology than seems possible at present. That they are not of Algonquin age seems definite. It is possible that they were deposited during the existence of one lake since there is no physical evidence of a cessation of deposition in any one deposit as seen in the pits. This lake must have existed prior to the advance of at least one late Pleistocene ice sheet. It may have been a proglacial lake in front of an advancing rather than a retreating body of ice, probably one of the Wisconsin advances, during which time there may have been several important oscillations in the ice front. This interpretation is necessitated by the overlying deposit of glacial till, the character of which will be discussed in the following section. Apparently the presence of Algonquin water had little effect on the Sheguiandah site as there are no lake deposits overlying the till.

THE TILLS AND ASSOCIATED DEPOSITS

In what has been referred to as the village area there is a concentration of small boulders (Figures 3 and 4) between the lake deposits and the overlying till. With these boulders are associated a few inches of a washed gravelly material which shows a stronger glacio-fluvial influence than the lake deposits and indicates a closer approach of advancing ice. Artifacts have been found in this material (Lee, 1957). The boulders may indicate an increase in ice rafting due to closer proximity to the ice front, and the gravels a closer supply of coarse sediment. It seems unlikely that this is a gravel deposit resulting from reworking and washing of lacustrine beds. Overlying these is a varying amount of glacial till, usually well under two feet thick, thinning over the areas of higher bed rock where it is in contact with the quartzite (Figure 5) and pinching out toward quartzite outcrops.

There is no doubt in the writer's mind that this is till, although its origin has been questioned. It is made of a heterogeneous mixture of material ranging from clay to boulders. It is not sorted except for the occasional sandy patches which are sometimes associated with till. The otherwise complete lack of sorting could ordinarily be obtained in only three ways: by mud flow, artificially, that is by a human agency, or by ice. Mixing by frost and/or root action does not need to be considered in this instance because mixing by these agencies would still leave the problem of derivation of this heterogeneous but relatively thin layer of material. It would also have destroyed the stratigraphy of the till. The presence of artifacts and artificial chips of quartzite is significant but does not indicate human transportation. There seems to be agreement among those students of primitive man with whom I have discussed this question that the deposits have not resulted from human activities.

Mud flow seems highly improbable, if not impossible. The thinness of the deposit coupled with the size of the boulders which it contains indicate that this explanation deserves but little consideration. The objection to frost action also holds here; the origin of the material would still have to be explained. The lack of an area from which the material might have flowed is also an argument against mud flow. It is true that there is some higher ground nearby but it does not seem adequate as an area of supply nor do the slopes seem steep enough to have caused this sort of movement. It must also be borne in mind that the till lies in a well-drained area certainly not conducive to mud flow. Moreover, if mud flow had ever been possible it should still be operative. Granted that there was an immediate agent of deposition other than ice, which the writer is not willing to do, it would seem that the material must have been originally brought to Sheguiandah by ice.

Perhaps the most conclusive argument in favor of deposition by ice is the stratification of the till into two layers. This is not apparent without close examination and careful comparison of materials; the determination of the age relationships of the till or tills is based primarily on the evidence of the artifacts. These show as clearly as might any other fossils in older formations that an unconformity must exist within the till since the artifacts in the upper portion are quite different from those in the lower. The distinctions between the two cultural levels represented have been discussed by Lee (1954, 1955) and need not be described here, except to say that the differences might not have been discovered except for the extremely careful and thorough stratigraphic collecting done by Mr. Lee and his crews, who in their detailed excavation have also found physical differences in the two tills. The evidence of two distinct cultural levels would certainly seem to eliminate frost or root action, and if they are mud flows, it is difficult to explain why there were only two or three and why these were so far apart in time that separate cultures had had time to appear. Transportation by ice would permit the condition as found although, as pointed out by Antevs (letter to Lee), the order of occurrence of the artifacts is not necessarily an indication of their relative ages. Even though the two layers of till were brought in by ice movements separated in time it does not follow that they came in from the same direction and the artifacts which they picked up along with other materials may have belonged to any one of the cultures which may have antedated that particular ice movement.

The projectile point horizon which occurs from six to eight inches below the surface is confined to a zone not over one-and-one-half to two inches thick. Artifacts are not numerous and some have been made of materials foreign to the site. This evidence points strongly to the existence of an old surface at the time the projectile points were accumulating and raises some conjecture regarding the overlying materials. It seems reasonably certain that the approximately six inches of surface material overlying the projectile point horizon was originally deposited as till. These materials have been modified considerably by organic agencies, including man and probably somewhat by rain wash, at least near the surface. Their general character shows a similarity to the underlying tills and indicates a common genesis. The artifacts show it to be a definite stratigraphic unit. There seems to be some question as to whether the upper six inches represents a modified till deposited by a third oscillation of an ice front or whether they were derived by a variety of means from local previously deposited tills. There has apparently been no recent surface washing as the forest litter and penetrating roots seem more than adequate to prevent this.

A few inches at the surface are dark colored from the presence of leaf mold and root penetration and below this a thin horizon has a reddish brown coloration due to weathering and oxidation. Nothing of this character has developed beneath the projectile point horizon or at any lower horizon. This must mean that either the time intervals between the deposition of the various beds were too short or the climate too rigorous for surface modification of soil to be accomplished.

Some generalizations may be formulated regarding the character of till deposition at this locality. Although the glacial sediments are apparently of Wisconsin age the location with respect to previous glaciation is significant. Most of the surficial materials were probably removed by older ice sheets so that the Wisconsin ice had very little sediment with which to work. This was particularly true in late Wisconsin time since early Wisconsin ice had also removed its share of sediment. The east-west direction of ice movement at the site indicates control by local topography and this may be indicative of a relatively weak ice sheet resulting in feeble erosion. Movement of ice during maximum development may have been largely by the overriding of bottom layers which because of their intimate relationship to the topography remained relatively stationary. Under these conditions local transportation of sediment might be limited to early and late glacial phases of any particular glacial stage and of short duration and movement. This would result in thin till sheets with much local material mixed with the debris from former glaciations. The presence of local artifacts and Ordovician shale boulders in the thin till sheets present at Sheguiandah seems to bear this out. Some of the artifacts have been broken and displaced, as discussed by Lee (1955, p. 65; 1957), but they do not show wear as might be expected from appreciable transportation. Moreover the quartzite in these artifacts appears to have had a local origin.

PRE-NIPISSING LOW LAKE LEVELS

An adequate discussion of the low level lakes which may have existed prior to the Nipissing Lakes and to uplift in the North Bay area will be left to specialists in this field. Mention of them cannot be omitted for as pointed out by

Antevs (letter to Lee, January 7, 1955) this low-level stage may have permitted ancient peoples to occupy much territory now covered by the waters of the present Great Lakes. The geography and chronology of these shrunken Great Lakes give an opportunity for many conjectures which will probably long remain in that category. It has been suggested by Hough (1955) that the low-level lake in the Huron basin be referred to as Lake Stanley.

THE NIPISSING GREAT LAKES

A well-developed Nipissing beach is present at an elevation of 650 feet at Sheguiandah at 70 feet above present lake level. On the eastern part of the south side and on the east flank are well-developed beach gravels seen on the surface at numerous points and in a test pit. These gravels occur on a terrace which is prominent on the aerial photographs. On the south side there is also a well-developed wave-cut notch. The beach is less marked on the west end and cannot be seen on the north side where there is a steep quartzite outcrop. The hilltop must have been an island at the time this beach was in process of formation. Lee (1955, p. 69) has indicated the significance of this beach. His findings show it to be a limiting factor in the distribution of the artifacts, and hence its age gives a minimum date for the last culture affected.

The age of the Nipissing Lakes has been the subject of much discussion. The writer does not propose to enter into this but simply to point out in passing that the variations in level of these relatively late lakes were controlled primarily by crustal warping and that these shore lines probably indicate a lower land level rather than a higher water level. The development of shore line features such as those at Sheguiandah must indicate a fairly stationary situation over an appreciable period of time, not the condition that might be expected if the land was rebounding from depression due to the weight of continental ice. MacLachlan (1951) has shown that upwarping in Ontario and Michigan may result from a tectonic tendency rather than release from the weight of the ice. This suggestion has considerable merit, particularly since operation of tectonic movements throughout geologic time is a well-established fact.

THE MYSTIC RIDGE

The 'Mystic Ridge' was so named by one of the members of the crew, David Sanford, because of the complete lack of even a working hypothesis concerning its origin. Several hypotheses were proposed. None of us could agree on any one of them. The name was an apt one and although additional excavation has cleared some points, it has stuck, and in many respects it is still applicable.

The ridge starts near the southwest corner of the hill and runs eastward for approximately 300 feet, then begins to curve gradually northward for another 300 feet until it bends sharply northward and becomes almost north-south in trend. Just north of the sharper bend it broadens and disappears. The total length of the ridge is nearly 1000 feet. Its surface drops fairly rapidly to the east and north and the total drop is at least 30 feet. The height varies somewhat but on the average will probably lie between 4 and 6½ feet. The width throughout its greater extent varies from 30 to 75 feet, the northern part being broader and the margins less well marked. The surface is composed of quartzite boulders. Most of these are natural boulders but there is some evidence of artificial fracture and chipping as there is everywhere over the surface of the site. This artificial material has no bearing on the origin of the ridge, and the forest cover is pretty much continuous over it bearing evidence of the soil beneath its surface.

Near the point of greatest curvature the ridge has been notched but is known to have been originally continuous since the material from the notch was removed for stone within historic time.

A few test pits were cut into the ridge and showed mostly boulders, but there was a complete lack of artificial flakes or chips beneath the surface. They also showed that the ridge was underlain or had as a core the edge of the dolomite cemented quartzite conglomerate and conglomeratic dolomite which was the first Ordovician deposit formed against the flank of the quartzite hill. During the current field season a trench was cut across the ridge to bed rock and the true character of the surficial material determined. It has a maximum thickness at the top of 2½ feet and is composed of a mixture of quartzite boulders and soil. Below the surficial materials the surface of the boulder conglomerate core appears to be considerably weathered. The dolomite matrix which holds the boulders together is much softer than the dolomite ledges cropping out at the surface. This may be in part due to retention of moisture under cover but not entirely so since weathering was so far advanced that the man making the cut had difficulty in determining at what point bed rock had been reached and actually removed a quartzite boulder from the conglomerate. Many of the boulders in the conglomerate showed bulbs of percussion developed by their being pounded together by Ordovician waves. Weathering around these features has proceeded much farther than it has around similar features more recently developed by ice or humans so that it is possible to identify some of the boulders which have been derived from the conglomerate. These boulders occur in the surficial material of the Mystic Ridge and indicate that it was derived from the conglomerate. This may have been accomplished by weathering of the conglomerate, but if so, it must have been largely accomplished in preglacial time since weathering to this extent could not have been completed since glaciation, as shown by comparison with exposed ledges of similar material. The soil intermingled with the boulders must have filtered down from the surface. That this could happen is shown by infiltration of soil in the beach gravels as pointed out to me in the field by Jaan Terasmae, now of the Geological Survey of Canada. This is not an entirely satisfactory explanation. If the surficial material of the ridge was formed by weathering of the conglomerate in preglacial time it is difficult to understand how it could have withstood glaciation. This may possibly be explained by relatively weak ice movement with local topographic control as explained in the discussion of the till. The till overlaps the margin of the ridge and this in itself seems sufficient evidence to establish the antiquity of the ridge.

CONCLUSIONS

The geological evidence makes it mandatory to consider the earliest artifacts at the Sheguiandah site as pre-Recent in date, that is prior to the close of the last glaciation. Humans may have fashioned artifacts from Precambrian quartzite in Wisconsin or pre-Wisconsin time in this area since these artifacts are incorporated in ice-deposited materials. The occurrence of artifacts in glacio-fluvial and lacustrine beds underlying the till strengthens this point of view. From the present evidence it is not possible to indicate even an approximate date in years but the artifacts must date back at least as far as a relatively mild interval in Wisconsin time or perhaps to the Sangamon interglacial interval. A date of an order of magnitude of 30,000 years B.P. which has been suggested by Antevs and Terasmae (letters to Lee) as a possibility may be far too conservative. It is not illogical to expect that humans may have come to this continent prior to Wisconsin time.

SUMMARY

The Sheguiandah site is archaeologically old enough and geologically young enough to afford considerable overlap between the two sciences. The present writing has been concerned primarily with interpretations which might be made from stratigraphic and sedimentological data and emphasis has been placed on determining the sequences of events rather than determining the absolute chronology. A more detailed correlation with the regional Pleistocene and Recent chronology will have to be done by students in that field.

The association of till and glacio-fluvial materials with artifacts places human occupation in this region well back in Pleistocene time. Man must have come into this area at least as early as one of the mild intervals in Wisconsin time or perhaps earlier. The till can be separated into at least two members on the basis of the artifacts and its identity is established by its sedimentary character. It seems impossible to use alternate explanations, mud flow or artificial origin to explain this type of well-mixed sediment. The underlying glacial lake clays with ice-rafted boulders must belong to an early lake, perhaps in front of an advancing rather than a retreating ice sheet. The concentration of boulders and the gravels at the contact of the clay and the till may indicate an approaching ice front.

The topographic background had been established prior to Pleistocene time; only details were added by Pleistocene ice. The thinness of the deposits probably reflects the position of this area with respect to the principal glaciations and the fact that it had been denuded of soil by the several previous glaciations.

The Mystic Ridge remains something of a mystery. It has as a core a ledge of dolomite and conglomerate over which there is a surface veneer of boulders and soil. This deposit is quite unique in the immediate area since it contains no artificially worked materials beneath its surface. It may result from the weathering of the bed, a conglomerate composed of quartzite boulders in dolomite, which flanks the quartzite hill on which the site is located.

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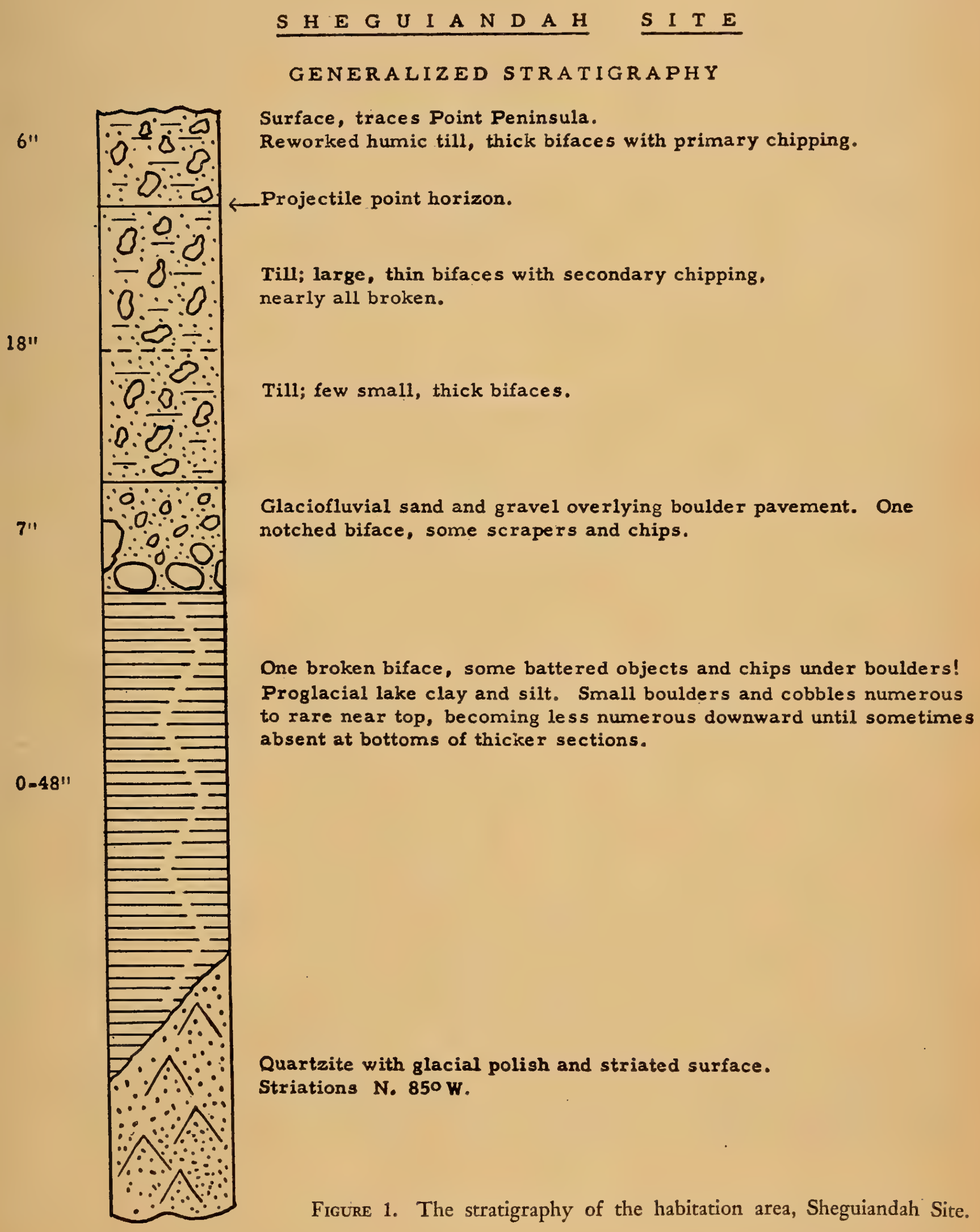
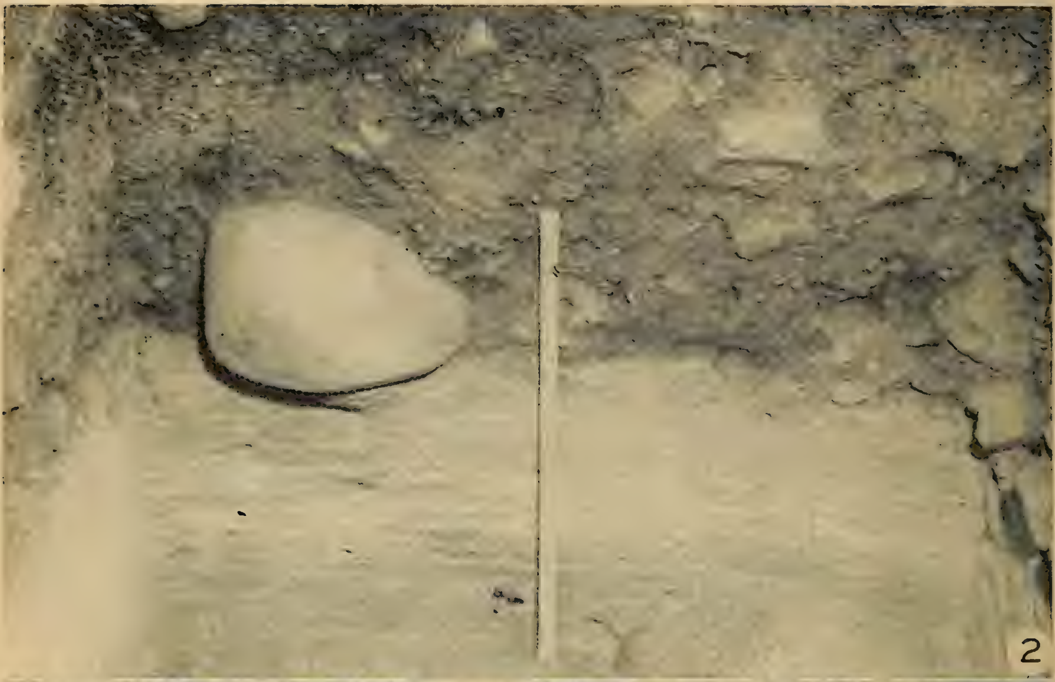

SHEGUIANDAH SITE
GENERALIZED STRATIGRAPHY
6"
Surface, traces Point Peninsula.
Reworked humic till, thick bifaces with primary chipping.
Projectile point horizon.
Till; large, thin bifaces with secondary chipping, nearly all broken.
18"
Till; few small, thick bifaces.
7"
Glaciofluvial sand and gravel overlying boulder pavement. One notched biface, some scrapers and chips.
One broken biface, some battered objects and chips under boulders! Proglacial lake clay and silt. Small boulders and cobbles numerous to rare near top, becoming less numerous downward until sometimes absent at bottoms of thicker sections.
0-48"
Quartzite with glacial polish and striated surface. Striations N. 85° W.

FIGURE 1. The stratigraphy of the habitation area, Sheguiandah Site.



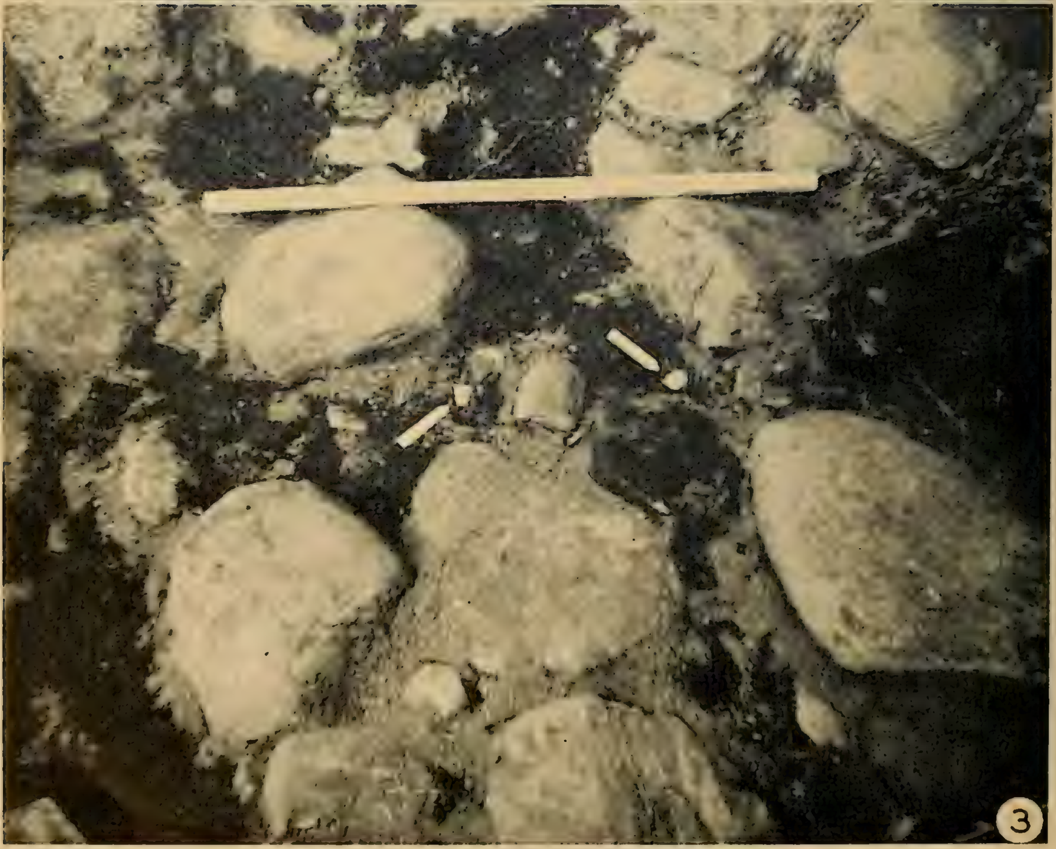
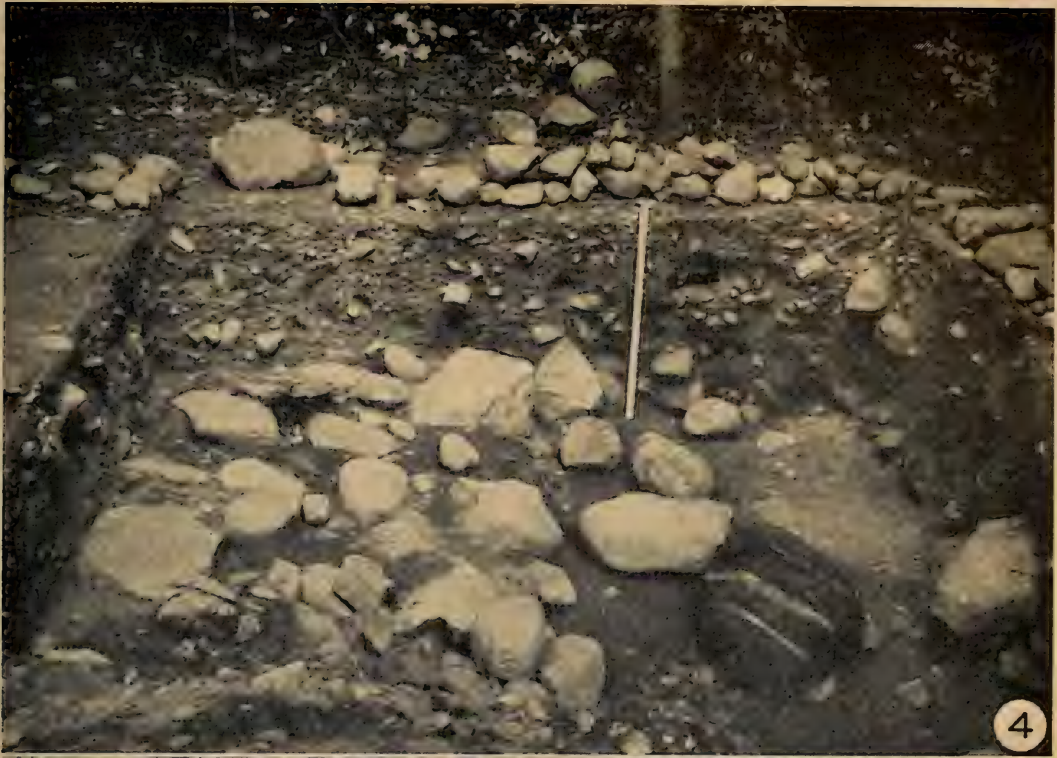


FIGURE 2. Till with boulders overlying glacial lake deposits.
(Photo by J. T. Sanford, Wayne University)

FIGURE 3. Boulder bed with gravel and artifacts (flakes) of quartzite. Detail of Figure 4.
(Photo by J. T. Sanford, Wayne University)



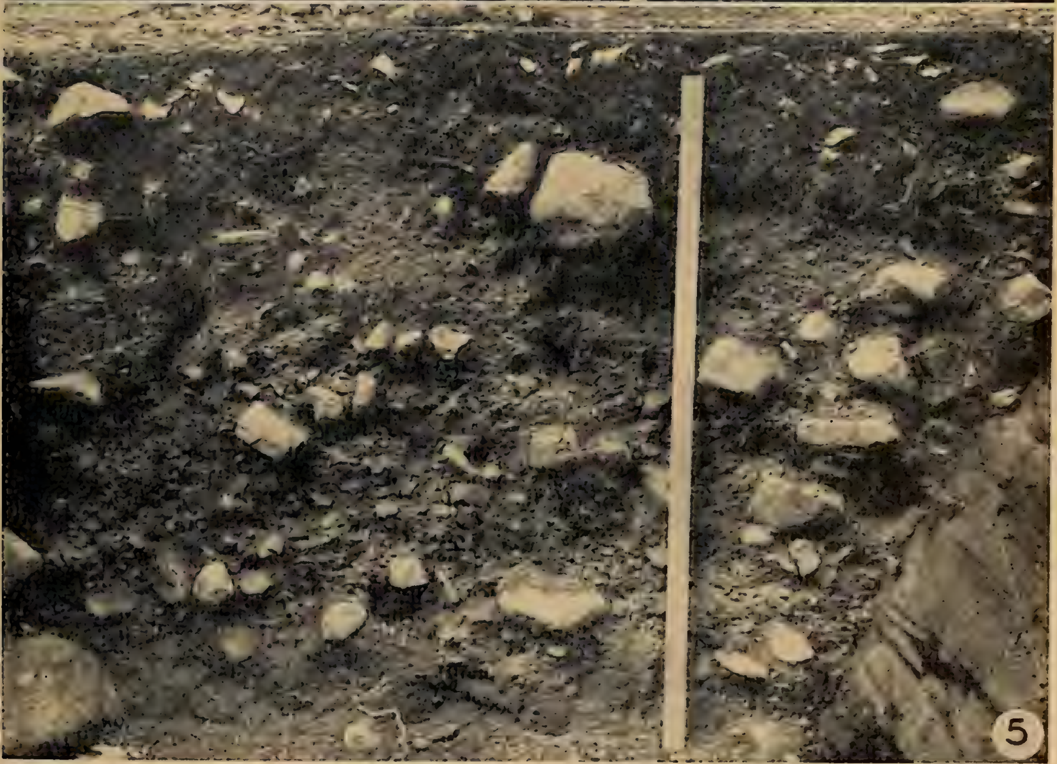


FIGURE 4. Boulder bed with gravel and section of overlying till.
(Photo by T. E. Lee, National Museum of Canada)

FIGURE 5. Till in contact with quartzite bedrock at right.
(Photo by T. E. Lee, National Museum of Canada)

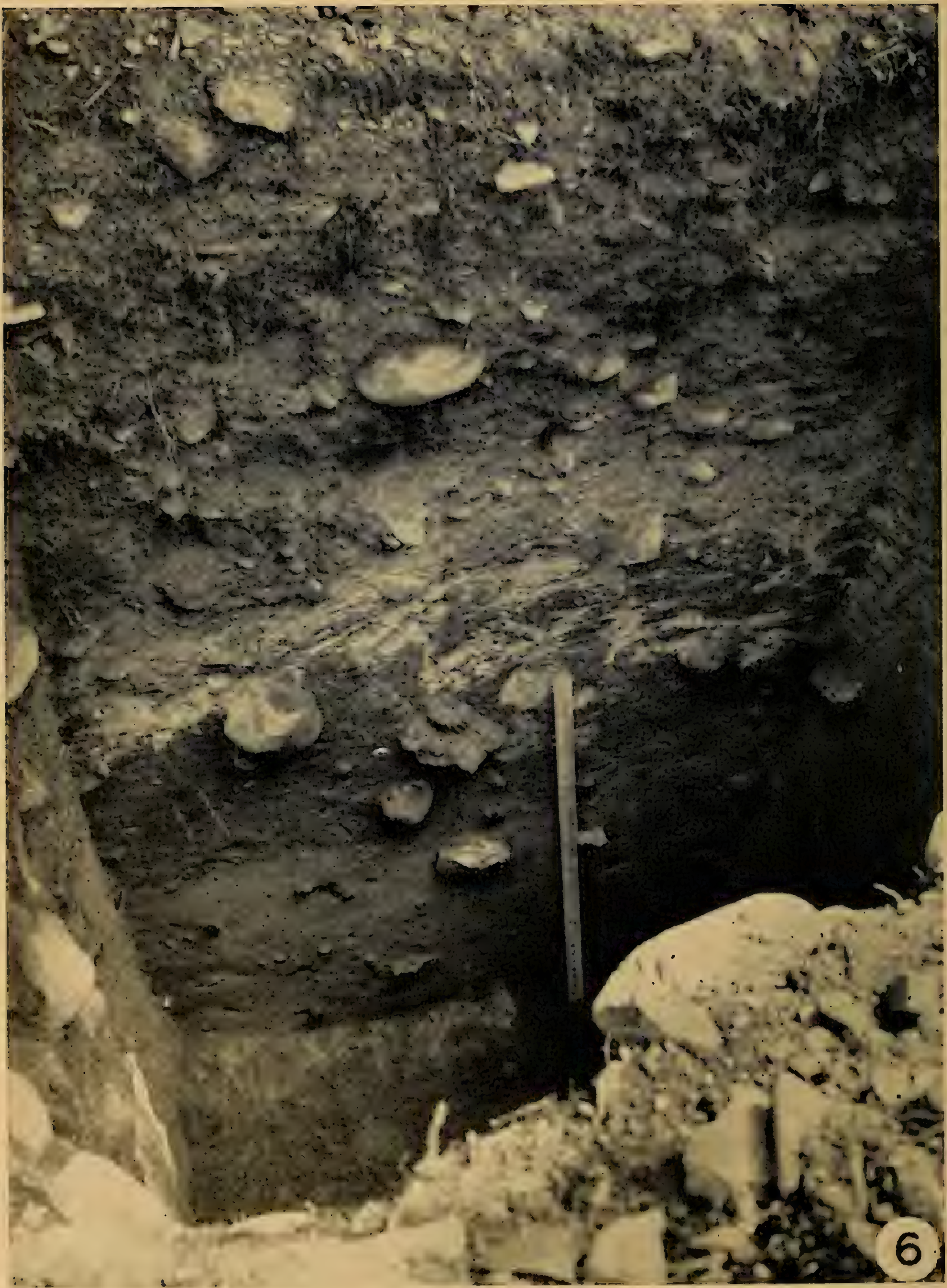


FIGURE 6. Test pit in Station 7-8 to bedrock, which is striated, fluted, and highly polished.
(Photo by T. E. Lee, National Museum of Canada)

NOTES ON A COLLECTION OF *GRYLLOBLATTA CAMPODEIFORMIS* WALKER

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Yale University School of Forestry, New Haven, Connecticut

Received for publication 19 February 1957

THE SELECTION of *Grylloblatta campodeiformis* Walker as the emblem for the Tenth International Congress of Entomology in Montreal shows the continuing interest which this group of insects arouses. This paper presents some notes on collections of *Grylloblatta* which I made during the summer of 1956.

Since 1914 when these insects were first collected and described (Walker, 1914), some sixty papers have been published on the Grylloblattidae (for sources, see Gurney, 1948, 1953). A number of new localities have been established and the type species has been reported from Montana (Chapman, 1953) and from interior British Columbia (Buckell, 1925; Campbell, 1949) as well as from the vicinity of the original collections (Ford, 1926). A few additional species have been found (Gurney, 1953) from both western North America and eastern Asia. Continued collecting has led Mills and Pepper (1937) to suggest that the insect may not be so rare as at first thought (Walker, 1914). The present observations support this view.

My collections of 1956 were made in Banff National Park not far from the areas where the insect was first taken. The locations from which insects were taken are marked on the sketch (Figure 1). Collections were made from Lake Agnes, Lake Louise, Paradise Valley, Wenchemna Valley, Taylor Lake, Smith Lake and Whiteman Pass. The altitudes of the collecting points ranged from 4700 to 7000 feet above sea level and the collecting period extended from June 22 to August 4. Insects of both sexes and of a number of instars were commonly recovered from the same collections.

Though Pletsch (1947) reports finding *Grylloblatta* in rotting wood, and in one case at least, more than a foot above the ground, most authors have reported the insects only under stones or in soil. During the present collections, insects were taken from moss over stones, from under stones and from the borders of springs, but the majority were taken from rotting wood. Though it was unusual to find insects within six inches of each other in the rotting wood, it was common to find five or more in a single log, apparently in the same fissures in the wood.

My collections were made during June, July and August. Most authors (Chapman, 1953; Mills and Pepper, 1937; Pletsch, 1947) report success only in the fall. The weather when my collections were made was in most cases, cold and wet. The greatest number of insects taken on a single day was secured from the Moraine Lake Valley on June 26 when the air temperature was about 30°F., snow was falling from a heavy overcast and there was a strong west wind. Under these conditions the insects moved briskly through rotting wood in which free ice was to be seen. When the weather was more moderate, in the same location, the insects were found lower in the logs and deep in cracks between the rocks.

When *Grylloblatta* was taken from rotting wood, the insects were always found in rather ill-defined galleries the sides of which were frequently lined with fungus mats. Under rocks and in moss, they were always found in places in direct communication with cracks leading deep into the ground. A number of insects eluded capture by running down these cracks before they could be picked up.

A number of animals were found associated with the *Grylloblatta* in rotting spruce logs. A series of collections of these animals was taken and found to include: larvae of at least three species of Carabidae, at least two species of Elateridae and of Therevidae, Bibionidae, and Tipulidae, Staphylinidae adults, a Cyclorrhaphous puparium (family not known), Campodeidae, millipedes (probably Julidae and Chordeumidae) and centipedes of the family Lithobiidae.

Head capsule measurements of all specimens are presented in Figure 2. Since the egg width is 0.71 mm (Crampton, 1927) it seems probable that the head width of the first instar is less than the modal measurement of 1.12 mm which represents the smallest of my three nymphal stages. The three animals in my largest size class were the only ones recovered that were certainly mature. On this basis, I

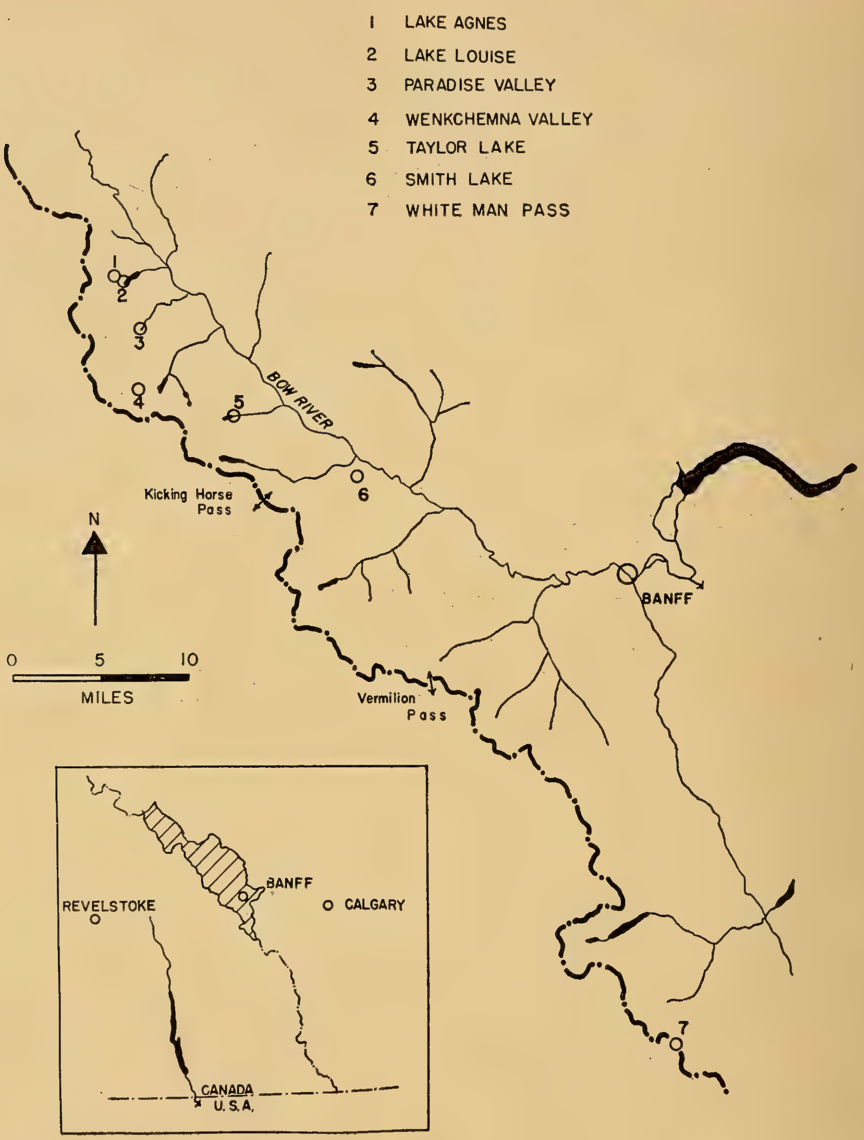

Figure 1. Sketch map of Banff National Park showing the location of collections of *Grylloblatta campodeiformis* Walker.

should place the lower limit of head size for adults at about 2.7 mm. The remainder of my insects seem to fall into three groups, centered around head width measurements of 1.12, 1.75 and 2.38 mm. On the basis of other measurements, I should ascribe the smaller two of these stages to "stages A" and "Stage B" of Walker (1919). The largest group of my nymphs falls between "Stage B" and maturity. There does not appear to be a different number of instars in males and females. Thus, there is at least preliminary evidence of four nymphal instars.

DISCUSSION

Grylloblatta campodeiformis Walker is probably not a particularly rare insect within the rather special local where it is able to live. During the season of 1956, the insect was recovered from eight locations, only two of which have previously been reported. No doubt, further collecting would reveal the insects almost anywhere in the main chain of the Rockies where suitable sites are to be found. The apparent relation between the weather and the success of collecting, and the habitat of the insects, lends support to Mills and Pepper's suggestion that *Grylloblatta*, rather than hibernating, may move up and down through the ground to a location where the temperature is favorable. A study of the temperature preference of the insect (Henson, 1957) as well as the findings of Edwards and Nutting, (1950) also supports this view.

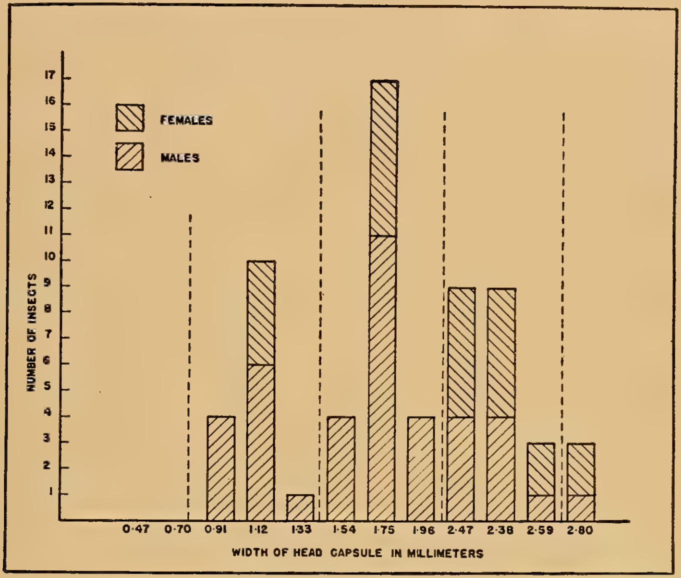

FIGURE 2. Width of head capsules in millimeters.

There has been no molting in a small series of insects held in laboratory culture for six months, though the insects have eaten regularly and appear to be in good condition. The variety of sizes of insects collected suggests that a period of years is required for maturation.

SUMMARY

1. The recovery of *Grylloblatta campodeiformis* Walker from a number of new localities supports other authors' conclusions that the insects are not so rare as previously thought.

2. On the basis of head width measurements, it is suggested that the insect has four nymphal instars and requires years to mature.

3. The possibility that the insect does not hibernate in spite of its extreme habitat is discussed.

ACKNOWLEDGMENTS

The collections reported in this note were made while the author was the guest of the Calgary Laboratory of the Forest Biology Division, Canada Department of Agriculture. I should like to express my thanks to that organization and to the members of the Calgary staff who assisted in field work. N. W. Wilkinson in particular helped me by collecting in areas which I was unable to visit. C. L. Remington of Yale University examined the associated insects and to him, also, my thanks are due.

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NOTES

Turkey Vultures Nesting in Northern Alberta

NESTING RECORDS for Turkey Vultures *Cathartes aura* in Alberta are sufficiently rare that two new records for the province in the summer of 1956 are considered worthy of recording here.

Nests of this species have been found before in Alberta as evidenced by Farley (Notes) who for many years from 1907 on, found them nesting regularly between the Second and Third Miquelon lakes. In the summer of 1922 Farley and Soper saw several in that particular area. Lloyd (Can. Field Nat. 36: 178-179. 1922) reported the nesting of Turkey Vultures on an island in Lake Astotin, Elk Island Park, in the summer of 1919.

During the summer of 1956 two reports of nesting Turkey Vultures came to my office. Dr. K. W. Tenove of St. Paul, Alberta, reported that a pair were nesting on an island in a small lake just out of St. Paul. Dr. Tenove had been observing the nest, which contained two youngsters, for approximately two weeks. Unfortunately the young and the adult birds were destroyed by vandals with .22 rifles a short time later.

A short time after Dr. Tenove's interesting report, Messrs. McKim Ross and Jack Owen, two enthusiastic Edmonton naturalists holidaying at Lower Man Lake near Ashmont, Alberta, which is approximately 80 miles from St. Paul, reported the finding of a Turkey Vulture's nest on an island in Lower Man Lake. Owen and Ross were able to obtain several excellent color slides of the single young bird at the nest and other shots of the adult birds. I investigated this find on 2 September 1956 and, with ornithologist William McKay of Calgary, was able to band the now almost fully fledged young vulture.

The discovery of two nests of this species, which is now very rare in Alberta, is significant from two viewpoints. It may indicate a return to an established nesting area that was never before discovered or to an entirely new one. Lake islands in this area are seldom inspected during the vulture nesting season. Secondly, a review of existing Alberta field records for this species indicates that these finds are the northernmost nesting records for the species in Alberta. It will be most interesting to observe what extended ornithological investigations on the Turkey Vulture in Alberta will disclose in the future.

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The Edmonton Zoological Society
10201 104th Street
Edmonton, Alberta
10 January 1957

Gyrfalcon in Alberta

ON 20 NOVEMBER 1956, Mr. Marcel Houle of the local taxidermy shop informed me that a Gyrfalcon *Falco rusticolus* had been brought to his shop by a hunter who had killed the bird in the Whitford Lake area approximately 65 miles east of Edmonton.

The bird was a large juvenile female which weighed 3 lb. 9 oz. Its total length was 22¾ inches; its wingspan, 48 inches.

The bird was slate-gray and had the distinctive vertical breast marking of the immature bird. It was in excellent flesh and feather. The mounted specimen will be forwarded by Mr. Houle to the Luxton Museum in Banff.

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10 January 1957

Steller's Jay in Central Alberta

AUTHENTIC RECORDS for Steller's Jay *Cyanocitta stelleri* from areas where the species is definitely out of its usual range are surprisingly rare in Alberta. Apparently it is a scarce probable resident in the mountains in the Jasper region and becomes more plentiful farther south through the Banff and Waterton regions.

Among the few unquestionable records east of the mountains and foothills the following are of interest. A. D. Henderson, the veteran oologist of Belvedere, told me that he received a specimen from an Indian who shot it across the Athabaska River in the Fort Assiniboine region. T. Randall, another veteran oologist in Alberta, informs me that he has seen the bird in the Porcupine Hills of Southern Alberta. Robert Lister of the University of Alberta Zoology Department has a record of a bird seen three years ago in the garden of Dr. Hocking's residence in south Edmonton. E. T. Jones (Notes) reports seeing a Steller's Jay in the Whitecourt area some years ago. Dr. E. O. Hohn of the University of Alberta was able to record on movie film this species on the farm of Mr. Pegg in the Glenevis area. The bird had been reported in this region for some days and appeared regularly in the morning at the Pegg farm.

The writer was fortunate enough to record a Steller's Jay feeding on a refuse pile near a trapper's cabin approximately 35 miles north of Fort Assiniboine. I was able to obtain a number of color slides and several feet of color movie film of the bird. George Leas, the resident trapper in the area, tells me that the bird has been feeding near his cabin for over 7 weeks. I first sighted the bird on 4 November, and Mr. Leas informs me that it had already been feeding there a week before that date.

Lack of any collected specimens has made it impossible to determine just what this race is.

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10 January 1957

A Snow Goose Breeding Colony in Ontario

IN JUNE 1950, A. S. Hawkins, E. G. Wellein, and W. F. Crissey of the United States Fish and Wildlife Service undertook an aerial reconnaissance of the James Bay - Hudson Bay region for the purpose of measuring waterfowl abundance along the coastal marshes and adjacent muskeg. They reported (Williams, no date) seeing three downy young with two adult snow geese *Anser caerulescens* on Cape Henrietta Maria. Manning (1952) had already drawn attention to the similarity of the terrain on Cape Henrietta Maria to that of the Southampton and Baffin Island nesting grounds and suggested that the species might breed there.

At the spring trapline meeting held at Attawapiskat in June 1956, further information concerning the breeding of this species there came from one of the Indians, Abraham Paulmarten, who reported that there was a colony of this species breeding west of Cape Henrietta Maria. The opportunity was taken to follow up this report when a Department of Lands and Forests aircraft was provided to fly a botanical party from the National Museum of Canada on a reconnaissance of the Hudson Bay lowlands. Mr. Nolan Perret of the Canadian Wildlife Service and the writer accompanied the party for the purpose of making waterfowl observations. On 11 July 1956, the party, while flying under excellent visibility conditions from an altitude of about 200 feet, saw pairs of snow geese of both the white and blue color phase with downy and half grown young. Three separate groups were encountered on the 55°7′N parallel at 82°32′W, 82°41′W and 82°47′W. All were concentrated where small rivers split into numerous channels on entering the flat coastal plain. The family parties were scattered among the small grassy islands and pools about half a mile inland from the normal high tide mark.

No estimate of total numbers was made at the time, but a count of all geese seen within a quarter mile of one side of the aircraft was taken by the writer. The strip through the first group gave approximately 200 geese, the second 300, and the third 30. Since the density of geese was roughly the same on both sides of the aircraft and birds could be seen in the distance well beyond the quarter-mile strip, it seems reasonable to assume that well over 1000 adult and young snow geese were present near the Cape in 1956.

Mr. C. Currie, Department of Lands and Forests, Sioux Lookout, questioned Mr. Xavier Chokomolin, an Indian from Sutton Lake, who regularly hunts on the Cape, about this snow goose colony. Mr. Chokomolin reported that the birds first started breeding there about ten years ago and have been increasing rapidly since.

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H. G. LUMSDEN

Ontario Department of Lands and Forests
Maple, Ontario
1 March 1957

A Terrestrial Turbellarian Flatworm Collected at London, Ontario

ON 13 FEBRUARY 1957, Mr. R. S. Dale, resident in London, Ontario, received two plants of Amaryllis which had been potted and kept in a greenhouse in London since the fall of 1956. On 17 February he placed the potted plants in a sink and thoroughly watered them with liquid fertilizer. A few minutes later a worm had moved out of one of the pots and was gliding about in the sink. When the worm was received by the writer two days later its posterior end had been amputated but it was still alive and was kept on damp earth in a dish for a few days. It moved about slowly with its lunate head swaying to and fro and the anterior border of the head rippling over the earth. By means of keys and descriptions in Hyman (1943), Pratt (1923) and Ward and Whipple (1945) it was identified as the turbellarian flatworm *Bipalium kewense* Moseley (Family: Bipaliidae).

While the worm was motionless and flaccid it was 50 mm long and 3 mm wide and when extended in active movement it was 85 mm long and 2 mm wide. The ground color of the dorsal surface was fawn and the central disc of the head was gray. A fine black stripe traversed the length of the body middorsally, and on each side of this stripe there were two wider stripes, a black dorsolateral stripe and a gray lateral stripe close to the margin of the body. Where the dorsolateral stripe and the lateral stripe approached the head they formed a dark blotch on the 'neck' of the animal. The ventral surface of the worm was dusky white. The specimen is preserved in fluid in the collection of the Department of Zoology, University of Western Ontario.

Bipalium kewense, described from specimens discovered in Kew Gadens in 1878, is cosmopolitan in distribution and is found particularly in greenhouses (Hyman, 1940, 1943; Walton, 1912). Hyman (1943) gives several records of its occurrence in the United States and Jackson (1940) records it from Manitoba. Its original home is unknown but Hyman (1940) reports that it may be inferred to have been somewhere in the Indo-Malayan region where the family Bipaliidae in centered.

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WILLIAM W. JUDD

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5 March 1957

Common Mummichog and Newt in a Lake on Digby Neck, Nova Scotia

IN HIS paper on fresh-water fishes of Nova Scotia Livingstone (1953) points out that the plateau of northern Cape Breton Island and Digby Neck are devoid of indigenous purely fresh-water fish. In the same paper he brings to our attention the fact that "as the variety of species becomes greater the territory occupied by each species will decrease." He illustrates this with an example of the killifish *Fundulus diaphanus* Jor. which in Nova Scotia often can be found in swift-flowing waters, an unusual habitat for this species.

In June 1954 during a visit to Digby Neck the author seined a small lake at Sandy Cove. This unnamed body of water, about one sixth of a mile long, is situated alongside the road leading from the highway to the shore of the Bay of Fundy. The elevation of this lake is between 50 and 100 feet. A small creek flowing into St. Mary Bay is the only outlet of this lake.

The only vertebrates caught with a small seine were the common mummichog *Fundulus heteroclitus* (L.) and the newt *Diemictylus viridescens* (Raf.), both of which were abundant. Among the invertebrates observed in the seine were the leech *Macrobdella decora* (Say) and several aquatic insects.

The fact that *Fundulus heteroclitus* enters fresh water is well known; however, that it will form what appears to be a permanent population is of some interest. It may be considered as another example indicating the versatility and plasticity of fishes (Larkin, 1956).

The presence of this large population of *Diemictylus viridescens* is similar to that reported by Livingstone (1953) from shallow lakes of plateau of northern Cape Breton Island, where this amphibian occupies the ecological niche of killifish, sticklebacks, minnows and young suckers. This indicates that *D. viridescens*, being a semiaquatic animal which can travel on the land, was able, after recession of the ice sheet from Nova Scotia, to repopulate this province faster than the freshwater fishes.

Specimens of these vertebrates have been deposited at the Royal Ontario Museum, Toronto, Ontario.

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W. L. KLAWE

Inter-American Tropical Tuna Commission
Scripps Institution of Oceanography
La Jolla, California
26 March 1957

Some Ottawa Bird Observations

RED PHALAROPE *Phalaropus fulicarius*. On 20 November 1948 a full-plumaged Red Phalarope was seen at Dow's Lake, Ottawa, by the author. It was particularly tame, and was observed at varying distances, as close as fifteen feet, through six-power binoculars for over half an hour. The dark area around the eye was noted, as well as the fairly heavy bill, yellow at the base with a black tip. The back was pale gray and unstriped. When first seen the phalarope was swimming and spinning just off the muddy banks of the recently drained lake. It was observed to swim several feet off shore, then fly to the middle of the lake. Here it remained only a few minutes, returning soon to the shore. As far as can be ascertained, this is the only recent record of this species at Ottawa.

WILSON'S PHALAROPE *Steganopus tricolor*. The first Wilson's Phalarope known to occur at Ottawa was seen on 24 May 1955 near Beattie Point on the Ottawa River by Dr. Peter Millman, Barry Millman, W. John Smith, and the author. When first seen, the bird, an adult female, was wading in the water, but it soon emerged on the grassy banks and was observed for a quarter of an hour from a distance of about forty feet. The bird appeared quite tame and fed frequently. It was seen later the same day by a number of members of the Ottawa Field-Naturalists' Club, but could not be found on the following day.

CAROLINA WREN *Thryothorus ludovicianus*. The first known observation of the Carolina Wren in recent years was made by the author at the edge of the area south of Dow's Lake known as Dow's Swamp. The bird was heard singing in heavy shrubbery but soon appeared in the open and was observed for several minutes at a distance of thirty feet. The white eye stripe and buffy underparts were clearly seen in good light through six-power binoculars. Shortly after the first observation the bird was seen and heard by Mr. Earle Covert, but soon became silent and could not be found again.

CLAY-COLORED SPARROW *Spizella pallida*. About 7.15 A.M. on the morning of 20 May 1954 the author's attention was caught by a repetitious buzzy bird song emanating from a bushy area in Dow's Swamp, near the southwest corner of Dow's Lake. Several minutes searching through thick shrubbery revealed the bird to be a Clay-colored Sparrow. The bird was observed at a range of from ten to thirty feet for a quarter of an hour, and every field mark noted through six-power binoculars. Later in the morning this bird was seen by several other Ottawa observers and heard by Mr. W. E. Godfrey of the National Museum of Canada. At noon it was still singing occasionally, but could not be found later in the afternoon. This is the first Ottawa record.

ERIC L. MILLS

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9 April 1957

REVIEWS

Wildlife Law Enforcement

By WILLIAM F. SIGLER. Dubuque, Iowa, William C. Brown Company Inc., 1956. Appendix, references, indexes, 38 fig. $4.50.

During the past twenty years great strides have been made in the new science of wildlife management. Much new information has been gathered about wildlife and many of the biological problems in the field have been solved or are well on the way toward solution. Wildlife management always involves the human element to a greater or lesser degree and in meeting the needs of that phase of the work progress has been less spectacular. Public co-operation, or the lack of it, in wildlife management is closely related to understanding of the policies and programs in use and the reasons behind them. Public understanding can come about in many ways but personal contact is still one of the best.

Dr. Sigler's book is a text developed to aid in the training of those wildlife workers who, more than all others in the field, have a primary responsibility to meet the public: the law enforcement officers.

Law enforcement need not wait until after a misdemeanor has occurred; indeed, the best law enforcement is preventative in nature. Adequate training of law enforcement officers is recognized as essential by most progressive game administrations. Many training courses have been given but it has remained for Dr. Sigler to bring together a comprehensive, well-rounded course within the covers of an easily read, carefully planned and well-documented text of eleven chapters.

In the first three chapters Dr. Sigler reviews the problems of wildlife law enforcement and sets forth clearly the distinctions between federal and state (provincial) laws and their implications. Chapter 4 covers the rights of private citizens under wildlife laws including the sometimes forgotten fact that private ownership of wildlife is a privilege, not a right. Private ownership can come about only under the terms of appropriate game laws of national, state or provincial, or more restricted scope.

Chapter 5 on violation of wildlife laws begins with an explanation of the difference between a crime and a misdemeanor. The majority of violations of wildlife law fall in the latter category since they are not necessarily "wrong in themselves" but rather are acts "prohibited by law." Many types of violations are discussed, and, as in all other chapters, there are useful examples taken from the records of actual court cases. Some attention is given to the physical hazards faced by officers in apprehending violators and this leads easily to a historical review of certain theories of crime and some of the factors leading up to violations. Education of the public and particularly of juveniles as a means of reducing violations is stressed.

Chapter 6 deals with the wildlife law enforcement officer. It traces the history of this subject and goes on to consider the desirable qualifications, both physical and psychological, of a modern officer. The point of view of the officer, his attitude to his work and to the persons with whom he deals and his code of ethics are all of great importance. His educational background and previous experience are continually becoming more important and some states already use university graduates. In many cases special training courses for game law enforcement officers are provided by the employing agency.

The author believes, and most forward-looking wildlife administrators agree, that the duties of the wildlife law enforcement officer —in some cases called conservation officer— are threefold. They include wildlife management, educational programs and law enforcement. The latter activity presupposes a knowledge of wildlife laws being enforced, of court rulings, of the rules of evidence, procedures for search and arrest and the use of side arms, official vehicle and often other specialized equipment.

Because of the importance of a proper understanding of the mechanics of law enforcement, including the many problems to be solved before and during the course of an arrest, Chapter 7 deals in detail with the subject of arrest. The importance of officer identification is stressed and in addition, the dangers of false arrest with its attendant embarrassment and loss to the arresting officer. The arrest of a dangerous criminal may involve danger to the arresting officer and requires a special degree of skill. Chapter 8 gives many helpful suggestions on this important subject.

Chapter 9 deals with the wildlife law enforcement officer in court. Needless to say this is the area where mistakes are both easy and important. All law enforcement work is in vain if the court presentation does not lead to conviction. Many phases of court conduct of importance to the officer are dealt with. Careful study of the information presented should ensure that violators do not escape their just deserts through errors in courtroom procedure.

Chapter 10 covers the all-important preparation of evidence. That this is the longest chapter in the book indicates the importance attached to the subject by the author. The coverage is comprehensive and this chapter alone is worth the price of the book.

Chapter 11 outlines briefly the future of law enforcement and again makes the point that wildlife laws should be simple, to the point, and well explained to the public. Public understanding of the reasons for the laws is of great importance and public education in this and related phases of wildlife work will continue to be an important responsibility of the enforcement officer.

Appendix A uses 55 pages to define legal and other important terms from *A Posteriori* to *X-Ray photograph*. It will do much to clarify thinking and to remove the possibility of misinterpretation of the author's ideas by the reader. Appendix B sets forth typical forms used in connection with court cases while Appendix C contains a very worthwhile series of 71 sample examination questions to test the grasp and retention of material presented in the book.

Fifteen references and a well-chosen list of almost 250 titles for suggested reading, grouped under 29 useful headings, provide access to much useful supplementary information.

An alphabetical general index, an alphabetical index of cases cited, a table of contents and a list of illustrations complete the book.

In a pioneer work of this kind critical readers will always be able to offer suggestions for improvement. In view of the pleasing presentation, careful choice of material and familiarity of the author with his subject this reviewer believes that the book will require a minimum of modification in future issues. It should be required reading for all wildlife law enforcement officers both present and potential. Even those with years of experience behind them will find many helpful hints. The book will also be useful to wildlife research personnel, administrators and amateur naturalists.

The type is easy to read, the illustrations good. The book is well made and pleasingly free from typographical errors.

V. E. F. SOLMAN

Farwelliana: An Account of the Life and Botanical Works of Oliver Atkins Farwell, 1867-1944

By ROGERS McVAUGH, STANLEY A. CAIN and DALE J. HAGENAH. Bloomfield Hills, Mich. Cranbrook Institute of Science, 1953. Bull. No. 34, 101 p. $1.00.

For 41 years Farwell served as botanist to the pharmaceutical house of Parke, Davis & Co. in Detroit. On weekends and on Wednesdays (which he 'took off' from drug inspection), however, he scoured the surrounding country for plants of interest to him for his herbarium. After retirement he devoted full time to the flora of Keweenaw Peninsula in northern Michigan.

As the result of these studies we now have an impressive array of critical and often provocative articles published in various botanical journals. In these no less than 1300 new names of plants are proposed, some 330 of them for Michigan plants which Farwell thought differed in some way from those already described. To be sure, many of these were minor variants but some were new species and genera. The printed diagnoses are sufficiently adequate to make his new names valid by publication but they leave much to be desired in way of details and supporting evidence. All future monographers will never-the-less have to give consideration to them, to accept or to reject them formally. It is against this eventuality that the present compilation becomes of great scientific help. McVaugh has gathered into one place all Farwell's new names, reprinted the descriptions, decided precise dates of publication and selected the 'types' from the some 15,000 specimens left by Farwell. This latter has been no easy task, with specimens variously filed, unmounted in assorted bundles and boxes accompanied by field trips full of abbreviations and numerical references peculiar to Farwell, and it is fortunate that such a student as McVaugh has taken up the matter.

The biographic sketch, factual yet sincere, has been provided by Cain who has included photos of Farwell, his herbarium and notes. Hagenah has compiled the list of 154 titles with bibliographic details.

W. G. DORE

Plant Classification

By LYMAN BENSON. Boston, D. C. Heath and Toronto, Copp Clark, 1957. Illus., 688 p. $10.50.

Here is a rather unusual way to start a textbook on plant classification: "In the 1880's the Apaches were on the warpath. . ."

The book is also remarkable in a number of other ways, the most obvious being the abundance, variety and attractiveness of the excellent illustrations.

This volume is designed primarily as a textbook for a taxonomy course in any North American university and should serve this purpose very well indeed. It is also a good reference book on the families of vascular plants and on the main floristic regions of North America, the central prairies and steppes excepted. Every plant taxonomist will also be interested to know that Dr. Benson offers in his book a new classification of the families of vascular plants. Some 333 families are recognized, 260 of dicotyledons, 46 of monocotyledons, 12 of gymnosperms and 15 of pteridophytes. The dicotyledons are subdivided into *Thalamiflorae*, *Corolliferae*, *Calyciflorae*, *Ovariflorae* and *Amentiferae*, with the *Ranunculaceae* as the first family of *Thalamiflorae*. This subdivision is strongly reminiscent of De Candolle and is a bit artificial as it brings together various evolutionary levels rather than evolutionary lines.

The book is divided into six sections as follows: Plant Identification, Flowering Plants, Gymnosperms, Pteridophytes, Plant Associations, and Appendix.

The first section on plant identification is very short, but it is supplemented here and there by various chapters on the identification of plants within each of the major groups treated. Also given is a list of the major floras and manuals on the plants of North America.

The section on flowering plants comprises first a series of chapters of descriptive botany and terminology, then the keys and enumerations of the families. Each family is described and briefly discussed and about half are illustrated. There follows an excellent chapter on plant collecting and the preparation of specimens for preservation in herbaria. The next chapter gives perspective to the book: it deals with evolution, a brief survey of the development of life, including animals, on the planet, embryology, plant distribution, genetics and the factors influencing the development of new taxa. Another chapter discusses taxonomic characters and their evolution. The classification of families is then given full treatment in three chapters, first the old artificial systems, then the recent natural systems, and last a justification of the classification adopted in the present textbook.

In the third and fourth sections the gymnosperms and the pteridophytes are given a treatment parallel to that accorded to the flowering plants.

Section five subdivides North America into nine floristic regions. Each is briefly described and discussed. Lists of characteristic species are given for some 30 floristic types. In most cases these lists are limited to the woody elements of the flora.

The appendix contains suggestions for the best collecting season in each of the floristic regions described; publications of the new names and taxa necessitated by the new arrangement of families, (for competing names see Bull. Soc. bot. Fr. 103: 492-494, 1956); a botanical glossary and a thorough index of the taxa and subjects mentioned in the text.

This is an outstanding textbook for a North American college or university and a must for every taxonomist the world over.

B. BOIVIN

On the Trail of Vanishing Birds

By ROBERT PORTER ALLEN. Toronto, McGraw-Hill Co., 1957. Photographs, 251 p. $5.50.

It is a moot question whether, in the scheme of things, the preservation at all costs of a species on the brink of extinction is of fundamental importance. Except in duration, the cycle is definite and unalterable: the coming into being, the being, the cessation of being. Apart from all sentimentality, one valid reason for preservation exists among a few, the opportunity that the precarious situation of the vanishing species offers to discover those peculiar factors upon which their existence ultimately depends and which otherwise might be missed or hard to find. The author has grasped this opportunity and so has made outstanding contributions to our knowledge of life and the histories of the Roseate Spoonbill *Ajaia ajaja*, the Whooping Crane *Grus americana*, and the Flamingo *Phoenicopterus ruber* in particular.

The book is not a bird book in the ordinary sense, nor is it an ornithological work. It is an account of the author's personal life and his adventures while he did his research on these three species. As such it is written with much verve, keen perception, and at times quite priceless humor. Amongst this altogether readable material, the drawing of the histories of the birds appears more like the backdrop than as the main theme, which may cause disappointment to some readers. The author himself, however, shows no lack of feeling for his birds around whose life and destinies most of his adult existence has been centered; and this lends the book its main interest and attractiveness. One recognizes the indefatigable quest and the spirit that never permits defeat. Although his literary style lacks some polish, time and again the author reaches heights of inspired writing. Such passages are his description of Florida Bay, the Flamingo, the hurricane in the Caribbean Sea, and others. At these moments he proves himself the "unabashed lover of nature" who must, indeed, always be a poet at heart.

The chapters on the Whooping Crane provide the most fascinating reading, describing the extraordinary ways and means by which the observer learned of its intimate life, the mapping of the migration route, the dramatic search in the north, even though in the end the reader with Allen never reaches the lost nesting grounds except by proxy, as it were. The final review of the birds which are disappearing or have become extinct within the time of our memory contains much food for thought. Here the author suggests another significant reason for their preservation, perhaps the most elementary as well as the most pregnant, that there will not be "a void in the April dawn," nor "an expectancy unanswered," nor "a tryst not kept."

LOUISE DE KIRILINE LAWRENCE

A Study of the Phylogeny of the Genera of the Tribe Coccinellini (Coccinellidae)

By W. Y. WATSON. Toronto, Royal Ontario Museum, 1956. 52 p. $1.25. (Contributions of the Royal Ontario Museum, Division of Zoology and Palaeontology, No. 42)

Most of our common lady beetles or 'ladybugs' belong to genera that have been grouped together in the tribe Coccinellini. These beetles are widely known, even to the general public, and are of considerable economic interest, because both the larvae and adults feed on aphids. However, they are poorly known taxonomically. Dr. Watson's study is an attempt to relate the genera of the world to one another in a manner more satisfactory than they have been related in the past.

After a historical review of the classifications that have been previously proposed for the genera, Dr. Watson presents a detailed, well-illustrated study of the external anatomy and genitalia of the genus *Anatis*. This serves as a basis for a study of the comparative anatomy of the genera. From an evaluation of the characters shown by the genera, whether primitive or more advanced, Dr. Watson derives a phylogenetic arrangement. He divides the genera into seven groups, which are assembled into three larger groups that Dr. Watson designates as tribes. Thus the old tribe Coccinellini is divided into three tribes, the Coccinellini, Anisostictini, and Hippodamiini. The paper ends with an appendix, which considers the validity of a number of the genera, and with a comprehensive bibliography.

A study of the phylogeny of a restricted group of beetles is of little general interest, but Dr. Watson's paper will interest students of phylogeny in general and coleopterists in particular.

W. J. BROWN

The Plankton of the Beaufort and Chukchi Sea Areas of the Arctic and its Relation to the Hydrography

By MARTIN W. JOHNSON. The Arctic Institute of North America, 1956. Technical Paper No. 1, 32 p., 11 fig., 15 tables. 50 cents.

From the standpoint of oceanography and distribution of littoral marine organisms the region of Bering Strait, Chukchi, and Beaufort seas is most critical and is currently receiving the detailed investigation that it warrants. Through analysis of zooplankton hauls made chiefly by the ice breaker *Burton Island* during the summers of 1950 and 1951, Dr. Johnson has considerably extended our knowledge of plankton distribution and marine hydrography into this American western Arctic region. The holoplankton was found to be dominated by copepod crustaceans; these have been grouped into (a) Pacific offshore species extending northward into the Chukchi Sea through Bering Strait, (b) subarctic neritic forms dominating the Chukchi and western Beaufort seas, and (c) arctic circumpolar species occurring not uncommonly in the eastern Beaufort Sea. The meroplankton was represented mainly by barnacle larvae; these were particularly abundant in the relatively shallow Chukchi and western Beaufort Seas but scarce in polar-derived eastern Beaufort waters. The author has utilized selected distributional patterns, reinforced by hydrographical observations, to outline the probable summer surface circulation, that is, a counterclockwise northward flow of relatively warm, saline, Pacific and subarctic neritic water and a clockwise westward flow of colder and less saline polar water meeting along a seasonally fluctuating boundary east of Point Barrow. He concludes with possible economic implications of differences in biological productivity between these two marine regions.

Although the author's general conclusions will probably be substantiated by further investigations, the reader might wonder whether vertical tows (100-0 meters) alone provide samples of surface plankton that are adequate for correlation with surface circulation in these relatively shallow coastal plain regions. The hydrographical significance of the distribution of larval barnacles would have been illustrated more positively had they been specifically identified; at least two and probably three or more species of these dominant benthic crustaceans having different ecological requirements and different distributions were probably involved. The author has ascribed geographical differences in the abundance of zooplankton to the relative shallowness of the western region which is more favorable to the neritic plankton, and to the strong river-derived influx of fresh water in the eastern region which would presumably suppress stenohaline marine forms. In this respect further investigation might show to what extent the greater prolongation of ice cover in the eastern region would be accompanied by decreased production of zooplankton through decreased wind stirring and upwelling bottom nutrient materials, and through decreased light penetration and reduced photosynthetic activity of phytoplankton in surface waters.

E. L. Bousfield

The Bird Biographies of John James Audubon

Selected and edited by Alice Ford. New York, The Macmillan Company and Toronto, Brett-Macmillan Ltd., 1957. 12 plates, 282 p. $10.00.

A great many naturalists know Audubon almost entirely through the plates of *Birds of America*, either the original elephant folio or octavo editions seen in some library or museum, or the Macmillan reproductions. Their acquaintance with his writings is largely confined to brief quotations in books or articles by modern authors. The editor and publishers have accordingly performed a definite service in presenting the first edition of Audubon's *Ornithological Biography* to appear since 1870.

The biographies were published, between 1831 and 1839, to serve as a text for the original elephant folio edition of *Birds of America*. In a foreword to the present selection of biographies Miss Ford tells us something of how Audubon struggled to complete this work. We all know people who seem to be struck by agraphia when required to write a report upon their observations. Audubon must have suffered severely in this respect. "For my part," he wrote despairingly to Bachman, "I would rather go without a shirt, or any inexpressibles, through the whole of the Florida swamps in mosquito time than labor as I have hitherto done with the pen." He had more cause than many to find his writing laborious, for his formal education had been sketchy, and the notes from which the account of each species had to be prepared were scattered through old journals in which they had been jotted down with no thought of future publication.

Miss Ford has selected eighty of the most complete and satisfactory biographies for her book. This seems a small proportion of the total; but she points out that many of the accounts are fragmentary, or are based on extralimital species, western species that Audubon never saw alive, or misinterpreted color phases or immature specimens. The chosen accounts are taken in part from the original *Ornithological Biography* and in part from the revised text that accompanied the octavo edition of *Birds of America*.

Within the selected accounts editing has been kept almost to a minimum. Modern bird names are given as necessary to avoid misunderstanding. Other errors or inaccuracies are generally ignored with the curious exception that many of Audubon's figures for clutch size are emended in footnotes. With almost nothing but his own observations to draw upon, Audubon generally could not give the full range of clutch, and the editor has in many instances supplemented it with a figure of her own. Unfortunately the corrected figure is often highly arbitrary and sometimes little or no better than Audubon's. These slightly aggravating notes might better have been left out and the reader simply reminded that the accounts contain errors and half-truths that would be inexcusable in a book written today. The selected accounts actually contain much more explicit errors than the ones that are corrected by the editor. Such are the statements that the tree-nesting ducks carry their young to the ground, and that the teals are the fastest of the ducks—two favorite errors of many a later author.

Despite its incompleteness, this book will give the reader who does not have ready access to an ornithological library a greatly enhanced appreciation of Audubon as a naturalist rather than merely as an artist. Nevertheless a prominent feature of this book, and one that partly accounts for its price, is that it includes twelve of Audubon's drawings that most of us have never seen. These hitherto unpublished drawings in the possession of Harvard University, some in water color and some in pastel, have been excellently reproduced by four-color photogravure. As Audubon himself protested, many of the plates in *Birds of America* acquired a harshness, particularly of the feathers, at the hands of the engraver. The illustrations reproduced in this volume show, by contrast, a delicacy and softness that are astonishing.

All in all, this book provides the public with a fresh insight into Audubon's achievements both as an artist and as a keenly observant field naturalist.

D. B. O. Savile

The Mammals of Keewatin

By Francis Harper. Lawrence, University of Kansas Museum of Natural History (Copies available from Arctic Institute of North America, 1530 P Street N.W., Washington 5, D.C.), 1956. 6 plates, 8 fig., map, 94 p. 75 cents postpaid. (Miscellaneous Publication No. 12)

This is the eleventh publication to appear about the results of a six-month field study which Dr. Harper carried out in 1947 on the west side of Nueltin Lake, District of Keewatin, N.W.T. The paper is a record of information obtained by Dr. Harper together with accounts of other investigators. It is an attempt to present in one volume current knowledge of Keewatin mammals.

Short treatments are given the physiography and vegetation of the study area, and of the comparative abundance of species. Harper has used the nomenclature of Miller and Kellog (1955) for his taxonomic categories. Sixty-eight pages are devoted to the accounts of 34 species with an additional page and a half to 13 other terrestrial forms. A systematic list of mammalian ectoparasites, with host records completes the presentation of data.

Harper's most valuable contribution is his section on rodents. Habits, reproduction, pelage, changes and ectoparasites are some of the topics he discusses. The section on carnivores is less extensive, with the exception of his treatment of the tundra wolf. The ungulates receive relatively little consideration.

Harper's field work was largely restricted to the Windy River area, and much of the original data in the paper came from the observations of Charles and Fred Schweder, then about 12 and 19 years old, respectively, of that region. For these reasons, the title of the paper is somewhat misleading, for Keewatin District is a large area of some 228,000 square miles. More properly, perhaps, the title should read "Mammals of the Windy River Area, Keewatin District, N.W.T., with notes on other Keewatin mammals."

It would be a rare paper with which one could find no fault and Harper's is no exception. Taxonomic usage can be a matter of personal interpretation, but one wonders why the genus name *Spermophilus* was used. One could wish for a standard presentation of measurements and weights of the rodents, particularly in tabular form.

In his discussion of the Arctic hare *Lepus arcticus andersoni*, Harper emphasizes its migratory character. One might argue for a dispersal onto the barrens rather than for a real migration. Because a youth has never seen evidence of a fox, red or Arctic, or a wolf catching Arctic hares, the reader shouldn't assume that hares are invulnerable to those predators. This reviewer has seen enough hare remains in the scats of wolves and Arctic foxes, as well as having observed a wolf catch a hare, to know otherwise.

If white whales are considered to be Keewatin mammals, one wonders why walrus and the several marine seals weren't also included in the paper. The size of a big white whale is given as 25 feet. This must be a typographical error, as a 15-foot animal would be large. Of 699 white whales measured in 1952 at Churchill, Manitoba, the longest was 13 feet 6 inches.

There are many other records of polar bears apart from those centering in Churchill, Manitoba, to indicate their presence in Keewatin District, particularly on Simpson Peninsula and Southampton Island. The more frequent recent records of red foxes and moose for Keewatin reflect a northern spread of these species.

It is to be regretted that Harper did not discuss the barren-ground caribou to a greater extent, for not all readers will have access to his publication, "The Barren-Ground Caribou of Keewatin." A detailed and comprehensive paper by A. W. F. Banfield (1954. Preliminary Investigation of the Barren-Ground Caribou. Parts 1 and 2. Can. Wildl. Service, Wildl. Mgt. Bull., Ser. 1, No. 10A, 79 pp.; No. 10B, 112 p.) contains additional caribou information which should have been considered.

A good map of Keewatin District, with adequate topographical references, would have enabled the reader to locate distributional records with much greater ease. The map in front of the paper is quite inadequate. The publication is generally free of printing errors. One important exception is the reference to W. H. B. Hoare, which is placed under Hewitt's name in the literature cited, instead of standing alone.

In summary, parts of Harper's treatment of Keewatin mammals are worthwhile contributions to knowledge. Much of its value is lost, however, by superficial considerations and by the use of extraneous material.

JOHN S. TENER

Field Book of Nature Activities

By WILLIAM HILLCOURT. New York, G. P. Putnam's Sons and Toronto, Thomas Allen, Ltd. 320 p., illus. 1950. $4.75.

There are, according to the author of this book, five main approaches to nature: knowing, probing, using, conserving, doing. The last aspect is his subject, the presentation of activities in the most immediate world of nature.

Now in its fourth impression, this volume has already taken a sure place in the Putnam series. Slimmer than many of the other admirable guides, it also differs in being not so much a book to be used in the field, as one to be referred to again and again, a source book for ways to explore the life around us.

Not the least important section of *Nature Activities* is the first part that sets the mental posture of the 'doer.' Hillcourt presents the idea that nature study should be not a set subject but an attitude that becomes a part of the life of the individual. Through the literally natural aspect of the pursuit the learner comes to know the interrelationship between all living things.

Advice on personal activities, what is needed and where and when to go, is followed by some good common sense to leaders. His advice is never trite; it is stimulating and inspiring. Hillcourt's experience in the Scout movement, no doubt, provides a good maxim, inherent indeed in the very word education: Don't pour in, draw out.

The greater part of the book is made up of specific projects, too lengthy to enumerate: how to make bird houses and feeders, simple traps for animals, cages for reptiles, knowing the insects and the vast world of water life, exploring the plant kingdom, taking moving and still pictures—many more satisfying, thrilling, challenging things to do. Every section has been checked by authorities in the particular subject.

An editor is perhaps expected to be a faultfinder. But there is little to find fault with in *Nature Activities.* One who wanted to get interested in the stars might be disappointed to find that Hillcourt evidently considered this branch of nature a little too remote. But the criticism is a slight one, and, of course, the publishers have already seen to the need in giving us a superb handbook for the amateur, *Field Book of the Skies.*

So, for the realization of greater enjoyment of nature, this is the book to get. There is no age limit to the person who can profit by this book. This reviewer, however, wishes especially that it might be within easy and constant reach of every high school boy and girl.

ROBERT A. HAMILTON

ANNOUNCEMENT

The Ninth International Botanical Congress will be held in Montreal, Canada, from August 19 to 29, 1959, at McGill University and the University of Montreal. The program will include papers and symposia related to all branches of pure and applied botany. A first circular giving information on program, accommodation, excursions, and other detail will be available early in 1958. This circular and subsequent circulars including application forms will be sent only to those who write to the Secretary-General asking to be placed on the Congress mailing list:

Dr. C. Frankton
Secretary-General
IX International Botanical Congress
Science Service Building
Ottawa, Ontario
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Webster's New International Dictionary is the authority for spelling.

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Other abbreviations should be used sparingly. The better-known terms of measurement follow CSA Specification Z85-1943 *Abbreviations for Scientific and Engineering Terms* or the equivalent of the American Standards Association (Z10.1-1941).

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BIRDS OF THE CLAY BELT OF NORTHERN ONTARIO AND QUEBEC

W. JOHN SMITH
40 Roslyn Avenue, Ottawa 1, Ontario

Received for publication 31 August 1955

INTRODUCTION

DURING THE summers of 1953 and 1954 I accompanied Mr. W. K. W. Baldwin of the National Herbarium, National Museum of Canada, as his field assistant on a botanical investigation of the Clay Belt of northern Ontario and Quebec. While helping to collect plants I had ample opportunity to make observations of the bird fauna of the region. In this paper I have collected my notes on those birds we saw or of which we found evidence. Most locations are shown on the accompanying map (Figure 1).

Our area is the former basin of the proglacial lake Barlow-Ojibway as outlined in the Glacial Map of North America, east half. The name Clay Belt refers to the varved clays laid down on the floor of the lake, and, so used, it demarks an area larger than either the Northern Clay Section of Halliday (1937) or the Clay Belt of Sharpe and Brodie (1930). In general it is a quite level area with poor drainage and many large bogs. There are fewer lakes than in surrounding areas, and they tend to be shallow and muddy, Lake Abitibi being a typical example. The rivers are generally sluggish, and also tend to be quite muddy. The seven most common tree species, in order of abundance, are *Picea mariana*, *Abies balsamea*, *Populus tremuloides*, *Pinus banksiana*, *Betula papyrifera*, *Picea glauca*, and *Populus balsamifera*. No other tree species, in the area as a whole, accounts for more than about one percent of the forest composition. Black spruce is the most common tree, accounting for about two-thirds of the forest (Sharpe and Brodie, 1930), and balsam fir is often found with it. Poplar and white birch also form large stands, and white spruce is not uncommon on the well-drained lands adjacent to the rivers. Black spruce, alder, willow, and larch are found in the sphagnum bogs. Jack pine, probably the second most common tree, is found in dense stands on all sand eskers throughout the Clay Belt, in the extensive sandy country around Matheson and Gogama, Ontario, and the western extremity of our area.

Throughout much of the northern Clay Belt, as far west as Hearst, land has been cleared for farming. In Ontario this has been principally along the highways, railways, and near the larger communities, but in Quebec it has been fairly extensive in several areas. Practically all of the forest is now within reach of pulpwood operations, although the northeast portion (Lake Waswanipi area) remains accessible only by canoe or aircraft. The southern Clay Belt in the vicinity of Lake Timiskaming (often referred to, in Ontario, as the Little Clay Belt) is now largely cleared for farming, and much of the uncleared land has been burned. What remains of the forest shows that it was not boreal, but of the Great Lakes – St. Lawrence Forest Region of Halliday (1937).

Because of the speed with which the forest is being destroyed or disturbed by farming, mining, lumbering, and pulpwood operations, I feel that it is well to set forth an account of its bird life at this stage. Moreover, the Clay Belt marks the northern, eastern, and southern limits of the present ranges of several species, and there is little published material concerning their breeding distribution there.

Means of access to our collecting areas was usually by truck, although on several occasions we used aircraft or some form of river transport. While collecting plants we traveled on foot or by canoe. Our itinerary, citing base camps, was as follows:

1953

June 18 to 22. Porcupine Lake, near Timmins, Ont.

June 22 to July 6. Kapuskasing, Ont.

Mailing date of this number: 14 December 1957.

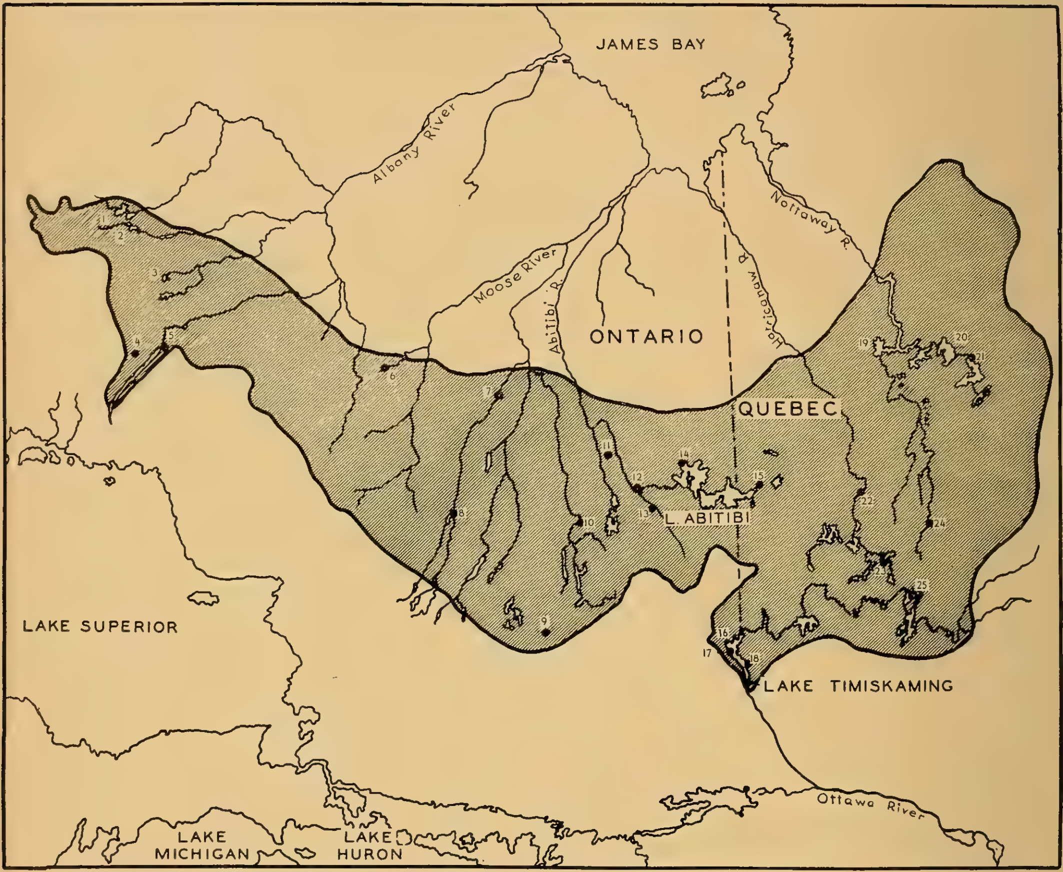

FIGURE 1. Map of the Clay Belt.

1. Ogoki Lake
2. O'Sullivan Lake
3. Nakina
4. Geraldton
5. Longlac
6. Hearst
7. Kapuskasing
8. Elsas, Kapuskasing Lake
9. Gogama
10. Timmins
11. Smooth Rock Falls
12. Cochrane
13. Iroquois Falls
14. Lowbush
15. La Sarre
16. New Liskeard
17. Haileybury
18. Ville Marie
19. Lake Mattagami
20. Lake Au Goeland
21. Waswanipi Hudson's Bay Company Post
22. Amos
23. Val d'Or
24. Senneterre
25. Lake Granet

July 6 to July 20. Cochrane, Ont., with two side trips to Lake Abitibi.
July 20 to Aug. 3. New Liskeard, Ont.
Aug. 3 to 17. La Ferme, near Amos, Que.
Aug. 17 to 31. Lake Blouin, just north of Val d'Or, Que.
Aug. 31 to Sept. 8. McMillan Lake, near Matheson, Ont.

1954
May 26 to 31. New Liskeard, Ont.
May 31 to June 6. Hearst, Ont.
June 7 to 17. Amos, Que., with a flight to Mt. Plamandon, June 10 to 15.
June 18 to July 9. Northeastern Clay Belt, by canoe. Details below.
July 10 to 16. Lake Granet, Que., on upper Ottawa R.
July 17 to 18. LaSarre, Que.
July 18 to 23. Ville Marie, Que.
July 23 to Aug. 3. Gogama, Ont., with a side trip to Elsas on Kapuskasing Lake, July 27 to 31.
Aug. 4 to 10. Kapuskasing, Ont.
Aug. 11 to 16. Kenogamisis Lake, near Geraldton, Ont., with a flight into northwestern Clay Belt on Aug. 13.
Aug. 16 to 20. Cochrane, Ont.
Aug. 21 to 23. Nepawa Island, Lake Abitibi, Que.

As the canoe trip into the northeastern Clay Belt figures prominently in many of the following observations it merits some description here. On June 18 we left the end of the existing road 43 miles northeast of Rapides des Cèdres, Quebec, and began a three-mile portage to the O'Sullivan River. We paddled down this river and across Lake Waswanipi to the Hudson's Bay Company post at the north end, arriving on June 25. On June 30 we left the area of the post and proceeded down the Waswanipi River to Lake Mattagami. On July 5 we climbed Mt. Laurier on the south shore of the lake and found that its peak was a small area of typically alpine habitat. We began to ascend the Bell River on July 6, and reached Rapides des Cèdres late in the evening of July 9. The trip afforded us a look at an area of undisturbed, typical Clay Belt forest, although our observations were somewhat hampered by unseasonably cold weather, excessive rain, and high waters.

During our two field seasons in the Clay Belt we were most fortunate in meeting several people who had an active interest in their vicinities and who gave generously of their time to help us. Some of these persons kept records of the birds they had observed, and placed these notes at my disposal. I have used only a portion of this unpublished material in this paper, but I feel that that which I have chosen will serve to give a fuller picture of the species known to occur. I am especially indebted to Mr. Fred Cowell of Timmins, Ontario, who has done a great deal of bird watching near Timmins, and to Mr. A. N. Boissonneau of Cochrane, Ontario. Others whose notes I have used are Mr. J. Coyne, Gogama, Ontario; Mr. K. Powell, Cochrane; and G. Beare, Kapuskasing. Mr. H. Cummings of the Ontario Department of Lands and Forests at Geraldton has recently begun a series of notes which will prove to be of great interest. Several other persons were able to give me valuable help although they did not keep bird records. Mr. E. Nelson took me to several interesting spots on Lake Abitibi in 1953, and he and Mrs. Nelson were of further help to us at Gogama in 1954. Mr. M. Loucks of Gogama, Mr. H. Whalen and Mr. L. Hemphill of Elsas, Ontario, were able to give me a good account of their local game birds. Brother C. Larose, C.S.V., of Joliette, Quebec, showed me several specimens he had taken at La Ferme, near Amos, Quebec.

I should like to thank the above people for all their help, and also the many people who, in various ways, helped to make our two summers both more fruitful and more pleasant. Mr. W. K. W. Baldwin, who was most considerate in giving me all the time required to make my observations, made many observations himself, which I have included in the paper. I am indebted to Mr. W. Earl Godfrey of the National Museum for his help in preparing this manuscript, and to Mr. Baldwin for reading it. Mr. James L. Baillie, Jr., of the Royal Ontario Museum of Zoology and Palaeontology has given much valuable information.

AN ANNOTATED LIST OF BIRDS

COMMON LOON *Gavia immer*. Noted on suitable lakes throughout the Clay Belt, and on some of the larger rivers. No nests were found, but young were seen in the Timmins and Kapuskasing areas. Fewer loons are present on Lake Abitibi than might be expected from the size of the lake, but Snyder (1928) attributes this to the nearly opaque muddy waters. Cormorants appear to have no trouble fishing there, however.

RED-NECKED GREBE *Colymbus grisegena*. I saw one in summer plumage on Porcupine Lake on September 5, 1953. On August 8, 1954, we saw 30 or more on Lilabelle Lake

just north of Cochrane. Most were adults in breeding plumage, but at least one was seen in autumn or immature plumage, and it appeared to be a slightly smaller individual. A. N. Boissonneau told me that these birds have been on the lake for the past two summers. F. Cowell noted this grebe in the Timmins area several times in 1952, once in mid-August 1953, and on August 14, 1954.

It would appear that this species is expanding its distribution in northern Ontario. Baillie and Harrington (1936) report it as a "rare summer resident of extreme western Ontario, west of Lake Superior," and mention a nest found about 50 miles west of Port Arthur. Snyder (1953) states that the concentration of the western Ontario birds centers around Lake of the Woods, and records several nests. He also remarks that the birds were not colonized. Baillie and Harrington (1936) say further that the species was recorded from James Bay by Macoun, and that a specimen has been taken at Moose Factory. Manning and Macpherson (1952), however, do not record it from the east coast of James Bay. It is of interest to note that Gunn (1952) in discussing its changing status in southern Ontario reports that hundreds now summer on Lake Ontario, and he cites several recent breeding records.

HORNED GREBE *Colymbus auritus*. I did not see this species in the Clay Belt, although Baillie and Harrington (1936) consider that it "probably breeds at many places in northern and western Ontario." F. Cowell has seen it in migration at Timmins for several years.

PIED-BILLED GREBE *Podilymbus podiceps*. We saw two adults and three young, too small to fly, on a silted beaver pond in jack pine forest six miles south of Matheson Ontario on September 4, 1953. On August 18, 1954, we saw one adult and two young on Lilabelle Lake north of Cochrane. Residents reported these birds to us occasionally from various parts of the Clay Belt. Baillie (1936) reports a few scattered summer records as far north as Moose Factory, but his only nesting record for the Clay Belt is from Timmins. The species is well reported from most areas immediately south of the Clay Belt, and its scarcity within the region is probably due to the infrequency of suitable lakes.

DOUBLE-CRESTED CORMORANT *Phalacrocorax auritus*. On June 24, 1953, we saw a single bird flying over Remi Lake not far north of Kapuskasing, Ontario. I saw another in Northwest Bay, Lake Abitibi, on July 13, 1953, and two days later we visited a seven-nest colony on a rock off Long Point. Local fishermen destroyed this colony. Residents of Lowbush reported another colony in the upper lake of Lake Abitibi, but we were unable to visit it. Snyder (1928) found no cormorants on the lake, and according to officers of the Department of Lands and Forests they first appeared about 1935. Double-crested Cormorants have been known to breed in Ontario since about 1920, and Baillie (1947) has traced the histories of eight known breeding areas exclusive of Lake Abitibi. The closest known colony to Lake Abitibi was discovered in 1912 by W. E. C. Todd (Lewis, 1929) at Rupert's Bay, Quebec, on James Bay.

GREAT BLUE HERON *Adrea herodias*. Evidently well distributed. In 1953 we noted it at Porcupine Lake (Timmins area), Lake Abitibi, in the New Liskeard area, and at a silted beaver pond six miles south of Matheson. In 1954, near Mt. Plamondon, Quebec; in the Ville Marie area; Gogama area; at Kapuskasing Lake, O'Sullivan Lake (north of Geraldton) and in the Cochrane area.

One heronry containing 17 nests was shown to me by E. Nelson on Three Mile Island, Northwest Bay, Lake Abitibi on July 13, 1953. Snyder (1928) found no heronry on the lake. J. Coyne told me of two heronries in the Gogama district with 14 and seven nests, and E. Davidson of the Forest Insects Laboratory told me of a 12-nest heronry about 20 miles southwest of the south end of Long Lake (Geraldton area), probably just out of the Clay Belt.

AMERICAN BITTERN *Botaurus lentiginosus*. Generally distributed in marshes and swales. In 1953 we saw it near Elk Lake, Ontario; Cochrane; at Lake Malartic near Amos; at a silted beaver pond six miles south of Matheson; and on the Mattagami River near Timmins. In 1954 near Hearst, Amos, Mt. Plamondon, La Sarre, Gogama, the Nemegesenda River (Kapuskasing Lake), and at Long Lake. Snyder (1928) records it as rare on Lake Abitibi.

CANADA GOOSE *Branta canadensis*. On July 8, 1954, I had a rather distant mist-obscured view of a bird which I think was of this species flying low over the water of Taibi Lake on the Bell River. Snyder (1928) reported hearing one at Lake Abitibi on June 6, and he considered it to be a belated migrant. Probably a few pairs nest within the Clay Belt although it is outside the principle nesting range described by Hanson and Smith (1950).

As would be expected, residents report that Canada Geese are very numerous in both spring and autumn migration.

BRANT *Branta bernicla hrota.* In late May 1953 about 2000 Brant arrived at Lake Abitibi and the Lowbush River in the vicinity of Lowbush. They were quite unwary, and were heavily preyed upon by the local Indians. E. Nelson arrested one Indian who had killed nine with a single shot from his cabin window. Two of those are now in the Royal Ontario Museum of Zoology and Palaeontology (hereinafter abbreviated as R.O.M.Z.P.). While with Mr. Nelson on July 13 I saw a group of seven Brant in Shea's Bay of Lake Abitibi. We landed on a small rock island and found at least eight pairs of Brant wings, evidently left by some Indians, and several of these are now in the National Museum of Canada (hereinafter abbreviated as N.M.C.). In a hollow we also found a compact nestlike circle of down containing two goose droppings and, very near by, a pair of wings. Unfortunately, I did not collect it. Baillie (1955) reports that 18 Brant spent the summer of 1954 on Kelly Lake, Copper Cliff, Ontario, which is south of the Clay Belt, and that Frank Fielding saw a pair with five young from August 12 to September 29. Mr. Nelson has since informed me that about 1000 of the Brant survived and remained at least until August in flocks of 50 or more. He observed many of them to molt. None of the local residents has any previous knowledge of Brant visiting the lake, and apparently none returned in 1954.

On May 27, 1954, Mr. Baldwin spotted a large flock of Brant feeding in a grassy field by the shore of Wabi Bay, Lake Timiskaming. We were able to approach quite close to them and count 250. The following day there were about 100 in the same field. As we had seen Brant on the Ottawa River near Ottawa earlier in the spring, we presumed that they may follow the river to Lake Timiskaming and thence overland to James Bay. Certainly they have been sighted at Ottawa for several springs now. A. N. Boissonneau saw 20 in late May 1954 near Cochrane which, like Lake Abitibi, would be on or near their route. Lewis (1937) in his discussion of spring migration of Brant traces one of their northward courses to Kamouraska and Ile Verte on the St. Lawrence River, and eventually to the Bay of Seven Islands. Brant following more easterly routes also arrive at the Bay of Seven Islands. From there they evidently use two separate overland routes, one to James Bay and one to Ungava Bay. On the basis of evidence which he sets forth in the paper, Lewis postulates that the smaller flock of Brant (the first mentioned) arrives at Seven Islands earlier, and departs earlier following the route to James Bay. This flock, at the time of his writing (1937), was nearly extinct. Perhaps the remnants of the flock now turn west up the St. Lawrence, rather than east down the river, turn up the Ottawa, and pass through northern Ontario. It is of interest, however, to note that Dr. Lewis was able to account for less than half of the Brant known to be wintering on the Atlantic coast of the United States. Some evidently swung even farther west in 1954, as 94 turned up at Gogama on May 18 and left on May 25. In the interim one flew into a telephone wire, was preserved in a freezer by the Department of Lands and Forests, and given to me for the N.M.C. in July. Mr. M. Loucks of that Department also reported that he had seen two Brant elsewhere in the Gogama area as early as the end of April, 1954. F. Cowell also reports Brant from the Timmins area on May 1, 1954.

SNOW GOOSE *Chen hyperborea.* I flushed an immature bird from the grassy edge of a marsh on Porcupine Lake, near South Porcupine, on June 19, 1953. A subsequent attempt to approach it with a boat, in order to collect it, failed, and the bird demonstrated ability to fly strongly, indicating that it was probably uninjured. Residents report that a few Snow Geese usually are seen with flocks of Blue Geese on spring and fall migration.

BLUE GOOSE *Chen caerulescens.* Reported by residents as a transient.

MALLARD *Anas platyrhynchos.* A moderately common migrant, probably nests sparsely in suitable marshes, at least in the western Clay Belt. In 1953, one was seen near Frederick House Lake, Timmins area, on June 22, two on the Harricanaw River near Amos on August 6, one near La Ferme in the Amos area on August 10. In 1954 one was noted on Ogoki Lake in the Geraldton area on August 13; five on Long Lake, Geraldton area, August 15; about 30 on Lilabelle Lake north of Cochrane, August 18; and ten or more on Nepawa Island, Lake Abitibi, Quebec, on August 21.

BLACK DUCK *Anas rubripes.* This is the most common of the summer resident dabbling ducks of the Clay Belt, but not to be considered one of the common summer birds of the region. Although a tally kept of each individual seen during the field season of

1954 revealed about 1200 each of Black Ducks and Golden-eyes, only 31 Blacks were seen during June and July, as compared with 109 Golden-eyes. During August the Black Ducks begin to wander and may be found in suitable marshes or sphagnum-bordered ponds in groups of 20 to 50, and residents tell me that they are common throughout the autumn.

Records kept during our canoe trip in the northeastern portion of the Clay Belt in June to early July, 1954, reveal that we saw only ten Black Ducks in about 250 miles of paddling, or four per 100 miles. On canoe trips east and north of the Clay Belt, Murray and Edward Rogers (Hanson, Rogers, and Rogers, 1949) saw 11 per 100 miles in 1947, and 20 per 100 miles in 1948, although the frequency varied from 0-33 per 100 miles. Our lower count may be partially attributed to unseasonally high waters, and to the fact that what was probably the best extensive habitat on the route was at the Hudson's Bay Company post on Lake Waswanipi, where 273 Cree camp throughout the summer. Snyder (1928) cites two breeding records from Lake Abitibi.

PINTAIL *Anas acuta*. Snyder (1953) considers the status of this species in the Kenora area to be the same as that of the Baldpate. It is a common breeder in James Bay (Baillie and Harrington, 1936; Todd, 1943; Hanson, Rogers and Rogers, 1949; Manning and Macpherson, 1952; Manning, 1952). Godfrey and Wilk (1948) report it as a rare summer resident which possibly breeds on Lake St. John, Quebec. Residents of Elsas told us that the Pintail is quite common some autumns, although it has not been recently. A. N. Boissonneau saw Pintails near Cochrane in the spring of 1950. We, however, saw only one bird, on Long Lake, August 12, 1954.

GREEN-WINGED TEAL *Anas carolinensis*. We saw a flock of 11 on the Harricanaw River near Amos on August 6, 1953, and one on Porcupine Lake near South Porcupine, Sept. 6, 1953. K. Powell tells me that it breeds in the Cochrane area. Godfrey and Wilk (1948) have reported it as a not uncommon breeder at Lake St. John, and it is known to breed commonly on James Bay (Baillie and Harrington, 1936; Hanson, Rogers and Rogers, 1949; Manning and Macpherson, 1952; Manning, 1952).

BLUE-WINGED TEAL *Anas discors*. Uncommon summer resident. Breeds. In 1953 we saw one on a small lake 12 miles south of Cochrane on July 10, 100 or more on Porcupine Lake on September 5, and 15 on Pearl Lake, Schumacker, September 6. In 1954 we saw about 20 including a female with several flightless young on Lillabelle Lake north of Cochrane on August 18, and 15 in a large marsh northeast of Nepawa Island, Lake Abitibi, Quebec, on August 21.

Godfrey and Wilk (1948) found a nest of this species at Lake St. John. Baillie and Harrington (1936) record it breeding only as far north as Lake Nipissing, which is south of the Clay Belt, and Snyder (1953) considered it a rare summer resident in western Ontario.

BALDPATE *Mareca americana*. Our observations of this species are insufficient to estimate properly its summer status, but it may be similar to its distribution in Kenora where Snyder (1953) considers it to be a rare but regular summer resident. Manning and Macpherson (1952) found it breeding on the east coast of James Bay in 1950 both at Moar Bay and Paul Bay, Quebec. Baillie and Hope (1943) saw only one at Rossport, on Lake Superior, on May 30, 1936, and considered it a belated migrant. In 1953 we saw one drake on Porcupine Lake on June 19, and four drakes on June 20. In 1954 we saw two drakes and three ducks at La Ferme, Amos area, on June 9, and one at Lillabelle Lake north of Cochrane on August 18.

WOOD DUCK *Aix sponsa*. We saw Wood Ducks only twice: one on a silted beaver pond six miles south of Matheson, September 4, 1953, and another in a large marsh in the northeast corner of Lake Abitibi, Quebec, August 21, 1954. F. Cowell told me that Wood Ducks are not uncommon in the Timmins area, and J. Coyne said further that they are fairly common about Gogama in the autumn. K. Powell, however, considers them rare in the Cochrane area. M. Loucks mentioned seeing a pair just south of Oba, Ontario, in the spring of 1950 or 1951.

REDHEAD *Aythya americana*. Rare. I saw one drake on Lillabelle Lake north of Cochrane on July 12, 1953. Residents of Elsas report seeing occasional flocks of this duck in the autumn, and were able to describe the birds quite well, having shot some.

RING-NECKED DUCK *Aythya collaris*. Uncommon summer resident. Probably breeds. In 1953 we saw two drakes on Twin Lakes, Garrison Township (between Matheson and Lake Abitibi) on June 19, three on the Kapuskasing River at Kapuskasing on June 22, and three on a pot-hole lake five miles south of Matheson on September 3. In 1954 we saw three pairs on a sedge- and willow-shored beaver pond just north of Hearst on June 2; three on a small lake in the same area on June

3; and one on a pond just south of Cochrane on August 19. Snyder (1928) collected a female in July on Lake Abitibi. F. Cowell informs me that one wintered for at least two years on Pearl Lake at Schumacher. There are several records of the species from the region around the Clay Belt.

Godfrey and Wilk (1948) report a pair near Lake St. John. Snyder, Logier, and Kurata (1942) record a drake on June 29 in the Sault Ste. Marie region. Baillie and Hope (1943) consider the species a rare summer resident of the northeast shore of Lake Superior. Manning and Macpherson (1952) saw several on eastern James Bay. The only definite breeding records for northern Ontario are from the Kenora and Thunder Bay districts (Baillie and Hope, 1936).

LESSER SCAUP DUCK *Aythya affinis.* Transient. We saw 20 on Pearl Lake, Schumacher, Sept. 6, 1953, and F. Cowell told us they were common in the area. Residents of Elsas reported that both Lesser Scaup and Greater Scaup, are late autumn migrants. Snyder (1953) considers *A. affinis* to be a rare summer resident of western Ontario, and Manning and Macpherson (1952) give evidence that both species breed on the east coast of James Bay.

GREATER SCAUP DUCK *Aythya marila.* Reported by residents to be a transient.

GOLDEN-EYE *Bucephala clangula.* The common breeding duck of the Clay Belt. Although we found no nests, we saw young in widely separated areas, and breeding records were reported by residents throughout the region. Of 204 individuals of six species of ducks observed in June and July 1954, 53 percent were Golden-eyes. During our canoe trip in the northeast portion of the Clay Belt (June 18 to July 9, 1954) we saw 84 Golden-eyes in about 250 miles, or 34 per 100 miles. On the canoe trips mentioned under the discussion of the Black Duck, Murray and Edward Rogers (Hanson, Rogers and Rogers, 1949) saw 11 (0 to 43) per 100 miles in 1947 and 13 (3 to 33) per 100 miles in 1948. Hanson saw 16 (9 to 54) per 100 miles on a canoe trip north of the Clay Belt, reported in the same paper.

SCOTERS. Although we saw no Scoters they are known in migration immediately north, east, and south of the Clay Belt. Residents of Elsas report large flocks of both Surf Scoters *Melanitta perspicillata* and White-winged Scoters *M. deglandi.*

L. Hemphill of Elsas described to me a drake Black Scoter *Oidemia nigra* which he shot on Kapuskasing Lake in the autumn of 1953. Mr. F. Cowell (oral) saw the White-winged Scoter at Timmins on May 16, 1954.

OLD-SQUAW *Clangula hyemalis.* Reported by residents to accompany the late autumn flocks of scoters.

HOODED MERGANSER *Lophodytes cucullatus.* The northern breeding limit of this species in the east is not well known. Manning and Macpherson (1952) found it at Paul Bay on eastern James Bay (not breeding) and considered that to be the "normal northern limit for the species in this area." Hanson (Hanson, Rogers and Rogers, 1949) found it to constitute about 5 percent of the duck population of the Palaeozoic Basin north of the Clay Belt in Ontario, but did not find it breeding. Godfrey (1949) considers it to be a rare summer resident of Lake Mistassini, and Wilk (Godfrey and Wilk, 1948) collected a second-year male on Lake St. John. Baillie and Hope (1947) found it breeding in the Sudbury area south of the Clay Belt. Snyder (1953) considers it a rare summer resident of western Ontario. In 1953 we saw a female with six to eight small young on the Kapuskasing River near Kapuskasing on June 27, in 1954 a female with six young on Minisinakwa Lake near Gogama on July 24, one on August 2 in the same area, two on July 29 on the Nemegesenda River near Elsas, and six on Kapuskasing Lake, July 30. K. Powell regards this species as not uncommon in the Cochrane area.

COMMON MERGANSER *Mergus merganser.* Although fairly common throughout most of the surrounding regions, this duck is less numerous in the Clay Belt than one might expect. We saw it in only three areas apart from the area covered by the canoe trip mentioned previously. On that trip we saw 27 or about 11 per 100 miles which is somewhat less than Hanson's 19 per 100, or Rogers and Rogers' 51 per 100 in 1947, and 32 per 100 miles in 1948 (Hanson, Rogers and Rogers, 1949). Perhaps I would have found it more numerous had our work taken us to more rivers than lakes instead of vice versa. The following are our other three observations: in 1953 one on the Mattagami River north of Timmins on June 21; several at the Montreal River mouth on Lake Timiskaming on July 31; and in 1954 on the Ottawa river one on July 11, three on July 13, and two on July 15. Snyder (1928) reports only one Merganser from Lake Abitibi. At Bank's Lake, Staples township, near Kapuskasing, a female was seen with young on June 24, 1925, by R. D. Usher (Baillie and Harrington, 1936).

GOSHAWK *Accipiter gentilis*. Positively identified on only two occasions. We saw one in mature black-spruce forest about 25 miles south of Kapuskasing and a mile west of the Kapuskasing River on June 30, 1953, and another among jack pines on an esker eight miles north of Villemontel near Amos on August 7, 1953.

SHARP-SHINNED HAWK *Accipiter striatus*. Well distributed. Breeds. In 1953 on Ile du Collège, Lake Timiskaming, we saw a family on July 24 and August 1 which Mrs. W. D. Cox reported to have been there for some time, and we saw one other individual in the Val d'Or area near Louvicourt on August 20. In 1954 we saw one at Mt. Plamondon on June 11; one being bothered by a Rusty Blackbird over the Waswanipi River near Lake Waswanipi on June 28; one that stopped to inspect us with curiosity from a distance of about 20 feet in a fir forest on Mt. Laurier at Lake Mattagami on July 5; one vigorously attacking an adult Bald Eagle on July 30 at Kapuskasing Lake; and three probable Sharp-shins at Lillabelle Lake north of Cochrane on August 18. Snyder (1928) saw several at Lake Abitibi.

COOPER'S HAWK *Accipiter cooperii*. Apparently reaches its northern summer limit in the Clay Belt, although Bremner (1949) reports one from Casummit Lake, north and west of the Clay Belt, 100 miles north of Sioux Lookout. F. Cowell and I, on September 6, 1954, saw two together about four miles north of Timmins.

RED-TAILED HAWK *Buteo jamaicensis*. Not uncommon throughout the Clay Belt, evidently similar in status there to areas east (Godfrey, 1949) and west (Baillie and Harrington, 1936, and Snyder, 1953). In 1953 we saw one in a two-year-old burn area 10 miles north of Edes, North-east Bay, Lake Abitibi, on July 14, and another on August 31 about eight miles east of Cadillac, Quebec. In 1954 we noted one over the Bell River a few miles north of Rapides des Cèdres on July 8, and four perched on the tops of black spruce (three of which were close enough together to be members of a family) between Hearst and Longlac along the Trans-Canada Highway on August 10. Only one was seen as we returned east along the route on August 16. Snyder (1928) saw one on the Ghost River near Lake Abitibi. Baillie and Harrington (1936) cite two records from near Kapuskasing. F. Cowell reports it common in the Timmins area.

RED-SHOULDERED HAWK *Buteo lineatus*. We did not see this species, but Snyder (1928) reports it as "heard and seen on a few occasions near Lowbush." F. Cowell has seen the bird near Timmins in the spring and summer. Apparently the northern summer limit is reached in the Clay Belt.

BROAD-WINGED HAWK *Buteo platypterus*. Common. The Clay Belt lies well within the range given by Baillie and Harrington (1936). In 1953 we saw a pair at the junction of the Kamiskotia and Mattagami Rivers north of Timmins on June 21; we noted the species in the Kapuskasing area; one at the Montreal River mouth on Lake Timiskaming on July 31; a pair at La Ferme near Amos from August 4 to 17; and one at Lake Blouin, Val d'Or, on August 17. In 1954 we observed a pair at the head of Dunlop Bay, Lake Mattagami, on July 5; one at Lake Granet on July 10, 11, 12, and 14; and one in the Gogama area on July 26. Snyder (1928) considers it "the commonest hawk" of the Lake Abitibi region. Baillie and Harrington (1936) cite breeding records from "near Gogama" and near Haileybury.

BALD EAGLE *Haliaeetus leucocephalus*. Not occurring in the center of the Clay Belt, but inhabiting relatively clear waters on the periphery. We saw it first while canoeing in the northeast part of our region, on June 30, 1954, over the Waswanipi River just below Lake Waswanipi; one again on the Waswanipi River between Lake Au Goeland and Lake Olga on July 1; and one just east of Dunlop Bay, Lake Mattagami on July 5, 1954. Near Dunlop Bay we passed from the clear waters of the Waswanipi system into the muddy waters of the Bell, and as we proceeded south up the Bell we saw no more eagles. On July 30, 1954, we saw two adults and one immature (flying) at Kapuskasing Lake, and residents tell us that the eagles are perennial summer residents. The last eagle we saw flew in front of the aircraft as we were landing on Melchett Lake in the northwest corner of the Clay Belt on August 13, 1954. K. Powell reports that eagles nest just north of (the presumed boundaries of) the Clay Belt at Little Abitibi Lake. F. Cowell tells me he has seen Bald Eagles at Timmins on migration. M. Loucks reported that he has recently seen Bald Eagles feeding on deer carcasses in winter just south of the Clay Belt.

GOLDEN EAGLE *Aquila chrysaetos canadensis*. I know of only one record within the region, a specimen collected by G. Beare near Kapuskasing, and now in the R.O.M.Z.P.

MARSH HAWK *Circus cyaneus.* Well distributed throughout the Clay Belt about ponds, sphagnum bogs, marshes, and, as would be expected, farm fields. The species was not seen during our canoe trip to the northeast corner of the region.

OSPREY *Pandion haliaetus.* Occurs in the same areas as the Bald Eagle, but also where we did not find the latter. In the course of our observations we saw this bird usually about relatively clear waters. In 1953 we saw one 15 miles northwest of Cochrane on July 11, and another over Lake Blouin, Val d'Or, on August 26, 27, and 28. In 1954 we noted single Ospreys on five separate days between June 30 and July 9 on the Waswanipi and Bell Rivers, one at Lake Timiskaming near Ville Marie on July 22, one in the Gogama area on July 26, one at Kapuskasing Lake on July 28, one along the Kapuskasing River near the lake on July 29, one on the Meta River near Melchett Lake in the northwest corner of the Clay Belt on August 13, and one at Long Lake, Geraldton area, on August 15. Snyder (1928) saw a pair near the Narrows of Lake Abitibi, and found a nest by the Ghost River just south of the lake. Waters in this area are exceptionally muddy. F. Cowell tells me that Ospreys nest at Kamiskotia Lake near Timmins.

PIGEON HAWK *Falco columbarius.* Positively identified on only two occasions. On July 26, 1954, we had an excellent look at a female which flew to the top of a tall dead tree in black spruce forest about 16 miles south of Gogama. We saw a female again on August 3, 1954, about three miles south of Gogama. On September 5, 1953, I saw a small falcon, apparently of this species, catch a small bird over a beaver pond in jack-pine forest near Matheson. Snyder (1928) reports taking two young, not fully feathered, from a family on Coney Island, Lake Abitibi. Both A. N. Boissonneau and K. Powell have seen Pigeon Hawks near Cochrane.

SPARROW HAWK *Falco sparverius.* Very common in all farmed portions of the Clay Belt. Scattered throughout the forest, but numerous about barns, cut-over areas, and flooded shores.

SPRUCE GROUSE *Canachites canadensis.* Fairly common throughout the region in both black spruce and jack pine forest, although residents consider it to be less common than the Ruffed Grouse in southern areas. Breeds.

RUFFED GROUSE *Bonasa umbellus.* Common throughout the region in black-spruce and jack-pine forest, as well as in poplar growths. Residents consider it less common than the Spruce Grouse in northern areas. Breeds.

WILLOW PTARMIGAN *Lagopus lagopus.* E. Nelson and K. Powell reported seeing Ptarmigan occasionally in severe winters at Cochrane, and mentioned in particular one winter about 1932. L. Hemphill said he saw a few near Elsas in a very severe winter (probably the same one) about 1933.

SHARP-TAILED GROUSE *Pedioecetes phasianellus.* Known to breed in several areas as Lake Abitibi (Baillie and Harrington, 1936) in the northern Clay Belt, but I did not see the species. The N.M.C. has seven specimens taken at Cochrane on December 7, 1932. Sportsmen throughout the region consider it not uncommon in autumn and winter, and L. Hemphill told of seeing very large flocks during the severe winter in which he also saw Ptarmigan.

SORA *Porzana carolina.* Evidently fairly rare. In 1953 I heard one at Porcupine Lake on June 19, and another whinnying in the Cochrane area in late July. On August 15, 1954, we heard one calling in a large cattail marsh at Long Lake in the Geraldton area. Snyder (1928) collected the one individual he found at Lake Abitibi. F. Cowell tells me the Sora breeds at Pearl Lake, Schumacher.

VIRGINIA RAIL *Rallus limicola.* F. Cowell has seen this rail in summer at Timmins, and A. N. Boissonneau saw one at Slaughterhouse Lake, Cochrane, on June 18, 1950.

AMERICAN COOT *Fulica americana.* Mr. Baldwin heard two calling from the sedge shore of a beaver pond just north of Hearst on June 2, 1954, while I was collecting elsewhere. He took me in to the pond later, and although the birds were still calling we did not see either one. On August 18, 1954, we flushed one from a cattail marsh on Lillabelle Lake just north of Cochrane. According to J. Coyne, Coots are common in the autumn at Gogama.

RINGED PLOVER *Charadrius hiaticula.* Transient. We saw six on August 6, 1953, on the muddy shore of the Harricanaw River near Amos, one on August 14, and one on August 17. F. Cowell has seen them on migration at Timmins.

KILLDEER *Charadrius vociferus.* Common throughout the Clay Belt wherever suitable open pebbly or muddy shore space exists. Also common in farm fields.

BLACK-BELLIED PLOVER *Squatarola squatarola.* In a plowed field near Uno Park (north of

New Liskeard) we saw two of these birds in full plumage on May 29, 1954.

GOLDEN PLOVER *Pluvialis dominica dominica.* F. Cowell has seen Golden Plovers in the autumn of 1953 and on September 23, 1954, at Timmins. On September 27, 1953, he picked up a dead bird on the golf course at Timmins, and the specimen is now in the N.M.C. J. Coyne has seen the Golden Plover in autumn migration at Gogama and examined one of the birds which was killed.

COMMON SNIPE *Capella gallinago.* Uncommon summer resident, found locally in suitable marshes. I did not see snipe during 1953, although they were reported to me by E. Nelson from the Lowbush River near Lake Abitibi, by both Mr. Baldwin and F. Cowell from the Timmins area, and by Brother C. Larose from La Ferme near Amos. In 1954 I saw one on June 2 at a sedge-shored beaver pond just north of Hearst, another in a marsh on the Nemegesenda River near Elsas on July 29, and two on August 18, in a cattail marsh at the north end of Lillabelle Lake just north of Cochrane.

WOODCOCK *Philohela minor.* Very rare. F. Cowell has one record for Timmins; A. N. Boissonneau saw two near Cochrane on May 13, 1950; and J. Coyne saw one in September 1952 and 1953 near Gogama.

SPOTTED SANDPIPER *Actitis macularia.* Common throughout the region along all creeks, rivers, and lakes. Nests with eggs were found by the Mattagami River north of Timmins and the Kapuskasing River south of Kapuskasing. Downy young were examined on a small island in Northwest Bay, Lake Abitibi. A total of 34 individuals were seen on our 250-mile canoe trip in the northeast of the Clay Belt or nearly 14 per 100 miles. This number is probably lower than might be expected, due to unseasonably high water.

SOLITARY SANDPIPER *Tringa solitaria.* On June 20, 1953, I collected a downy young of this species in Little Township north of Frederick House Lake, about one mile south of the hydro dam at High Falls which is on Frederick House River. We were driving along a lumber road through a cut-over black spruce area when a pair of screaming adults suddenly appeared beside the truck. We stopped immediately and spent the next fifteen minutes looking for a nest or young while the agitated birds came within ten feet of us. When it became evident that such a search was going to be very difficult it was decided that I should hide behind the roots of one of the many wind-fallen trees while Mr. Baldwin drove off to do botanical collecting at High Falls. About ten minutes after he left one bird settled down about forty feet away on a patch of moss and appeared to be brooding young which I could hear but not see. For the next twenty minutes I frantically searched the area while the parents approached to within two feet of me. Just as Mr. Baldwin returned I discovered one cheeping downy youngster hidden in a hole in the earth about the roots of an overturned black-spruce stump. So thoroughly was it hidden that only a leg was visible. The skin is now in the N.M.C. Mr. Baillie of the R.O.M.Z.P. has informed me that this is the only downy young yet collected east of Saskatchewan. I was interested to read J. Grant's recent note (1954) on his discovery of a downy young similarly hidden "in a deep hollow beneath some willow roots" in central British Columbia.

Snyder (1928) noted a few Solitaries near Lowbush where they were seen to perch on the tops of coniferous trees.

All our other observations of the species were during migration: in 1953, one on a drainage ditch through alder at Lake St. Georges, La Ferme, Amos, on August 15, and one on August 27 at Lake Blouin, Val d'Or. In 1954 we saw two at Jackfish Bay, Long Lake, Geraldton area, on August 12.

LESSER YELLOW-LEGS *Totanus flavipes.* Transient. In 1953 we noted two in a sedge marsh by Lake Malartic, Amos, on August 9, and three on a mud flat of Lake St. Georges, La Ferme, Amos, on August 15. In 1954 we saw five in an extensive cattail marsh northeast of Nepawa Island, Lake Abitibi, Quebec, on August 21.

GREATER YELLOW-LEGS *Totanus melanoleucus.* Reported as a transient by Brother C. Larose who has taken a specimen at La Ferme, and by F. Cowell at Timmins.

PECTORAL SANDPIPER *Erolia melanotos.* Transient. In 1954 we saw 11 on August 11 in an extensive sedge marsh on Kenogamisis Lake, Geraldton area, one in a cattail marsh on Jackfish Bay, Long Lake, Geraldton area, on August 12, and one each on Ogoki Lake and Melchett Lake in the northwest corner of the Clay Belt on August 13.

LEAST SANDPIPER *Erolia minutilla.* Transient. In 1953 we saw several on the Harricanaw River near Amos on August 14, and six on August 27 on Lake Blouin near Val d'Or.

STILT SANDPIPER *Micropalama himantopus.* Transient. I collected one fall-plumaged bird on the muddy shore of the Harricanaw River near Amos on August 14, 1953. The specimen is in the N.M.C.

SEMI-PALMATED SANDPIPER *Ereuntes pusillus.* Transient. In 1953 on the Harricanaw River near Amos we saw about ten on August 6, several on August 14 and 17; at Lake Blouin, Val d'Or, we saw six on August 27. In 1954 we noted 12 on August 12 at Jackfish Bay, Long Lake, Geraldton area, and three on August 18 on Lillabelle Lake north of Cochrane.

HERRING GULL *Larus argentatus.* A common nesting species on suitable lakes throughout the entire region. Well-grown young were examined on an island off Long Point, Lake Abitibi, on July 15, 1953. Snyder (1928) noted that they nested on at least one island in the lake.

BONAPARTE'S GULL *Larus philadelphia.* This bird is probably a rare and irregular breeder in the Clay Belt at least as far east as the Quebec border. We first saw one adult on a small lake near Frederick House Lake on June 22, 1953. The lake has about 50 acres of open water, is bordered by a large sedge marsh to the dry side of which is a sedge meadow, an open willow thicket, then, respectively, zones of *Betula pumila glandulifera*, Labrador tea and leather leaf, and finally black spruce. Throughout our stay at Kapuskasing, June 24 to July 6, 1953, we saw a breeding plumage adult on a similar small lake six miles west of Moonbeam. On June 28 I saw this bird attack a Marsh Hawk, and I spent about 30 minutes looking for its nest. Unfortunately I was unable to make a complete search. We did not see it on the same lake in 1954. On September 6, 1953, F. Cowell showed us four fall- and/or immature-plumaged individuals on Pearl Lake at Schumacher.

Cowell reports that Bonaparte's Gulls are present throughout the summer at Pearl Lake, and although he has not found a nest, he has seen them with their young. K. Powell reports several from the Cochrane area, most numerous in 1950. A. N. Boissonneau saw one at Lillabelle Lake in the spring of 1953. Snyder (1928) saw two at Shea's Bay, Lake Abitibi, in breeding plumage. J. Coyne saw four at Gogama from May 12 to 18, 1954.

COMMON TERN *Sterna hirundo.* Common Terns were seen frequently on lakes throughout the Clay Belt. They nest on several islands in Lake Abitibi. We visited one colony of about 25 pairs on a small rock island in Shea's Bay on July 13, 1953, and found young of various ages as well as several sets of eggs. On July 15, 1953, I collected an adult female from this colony. On Lake St. Viateur at La Ferme near Amos we saw two immatures being fed by adults on August 5, 1953. I found two sets of eggs on a large old pile of wood chips in Lake Figuery near Amos on June 8, 1954. On July 13, 1954, I found sets of one, two, and three eggs on a small island in Lake Granet, Quebec. On small islands in several other lakes during the breeding season we saw terns behaving in a manner which indicated that they were nesting.

BLACK TERN *Chlidonias niger.* On August 21, 1954, we saw over 30 Black Terns in an extensive cattail marsh northeast of Nepawa Island, Quebec, in Lake Abitibi. Several of these were obviously immature birds.

E. Nelson tells me that at least 1000 Black Terns summer at the mouth of the Ghost River on Lake Abitibi and that they first appeared about 1948. Snyder (1928) did not record them. F. Cowell has seen Black Terns near Timmins in the summer.

ROCK DOVE *Columba livia.* Common about farms, cities, and towns, and settlements along the railroads.

Morning Doves *Zenaidura macroura* were reported to me by at least three observers, but I have few data on the dates and places where they were observed.

BLACK-BILLED CUCKOO *Coccyzus erythropthalmus.* Not common, but widely distributed. Noted in greater numbers during 1953, a year of generally heavy tent caterpillar infestations. Several were heard in the Kapuskasing area between June 24 and July 6, 1953, frequently in alder thickets as well as in poplars. It was also heard commonly around Cochrane and at Lake Abitibi from July 6 to July 20, 1953, and two were seen in an alder bog. We heard one in an open scrub area about ten miles northwest of Timmins on September 6, 1953. On May 30 and 31, 1954, we heard and saw one in a grove of poplars by Lake Timiskaming near new Liskeard, and on May 31 we heard one at Hearst. Another was heard calling from the shore of Lake Waswanipi, Quebec, on June 25, 1954. On July 28, 1954, we heard two Black-billed Cuckoos west of Elsas, and on July 29, two more by the Nemegesenda River. The last we heard were near Kapuskasing on August 4, 5, and 6, 1954.

HORNED OWL *Bubo virginianus.* We heard one calling during the evening of August 21, 1954, on Nepawa Island, Quebec, Lake Abitibi.

Snyder (1928) heard Horned Owls at three places near the lake. E. Nelson reported Horned Owls in the Cochrane area and F. Cowell has taken a specimen at Timmins. A forester of the Spruce Falls Power and Paper Company described a family of these birds to me which he had seen a few miles north of Kapuskasing.

BARRED OWL *Strix varia.* We heard a Barred Owl calling a few miles south of Lake Waswanipi, Quebec, on the afternoon of June 21, 1954. Four days later I had a short, late-evening look at an owl, probably of this species flying into a bog by the Hudson's Bay Company post at the north end of the lake. F. Cowell has seen Barred Owls in both winter and spring at Timmins.

HAWK OWL *Surnia ulula caparoch.* Snyder (1928) found several Hawk Owls along flooded shores of Lake Abitibi, and found dependent young. F. Cowell has seen the Hawk Owl near Timmins in summer and fall, and has a specimen.

GREAT GRAY OWL *Strix nebulosa nebulosa.* F. Cowell has a specimen from Timmins.

WHIP-POOR-WILL *Caprimulgus vociferus.* Reaches its northern summer limit in part of the Clay Belt. I heard it only at Lake Laperrière near Ville Marie, Quebec, one on July 19, 1954, two on July 19, 1955, two on July 20 and 21, and one on July 22. Mr. Baldwin heard Whip-poor-wills at Matheson and Larder Lake. Foresters of the Canadian International Paper Company told me that they had heard Whip-poor-wills when camped on the north shore of Lake Simard, Quebec, in 1954. Baillie and Harrington (1936) record that the species nests near Uno Park, Ontario, north of Lake Timiskaming. East of the Clay Belt, Godfrey and Wilk (1948) record it as a "rare summer resident" of Lake St. John.

NIGHTHAWK *Chordeiles minor.* Well distributed throughout the entire Clay Belt, although, as would be expected, it is more common in farmed areas, and is always found in clearings of lumber camps.

In the evening of June 9, 1954, I watched three Nighthawks engaging in a curious performance around our tent which was set in a grassy field beside the Gold Belt Airways base on Lake Figuery. They were silently skimming, erratically, low over the grass, and every once in a while one would land and walk around. Two days later I saw a similar performance in the rough clearing about a small cabin beside a small nameless lake about four miles east of Mt. Plamondon. Again three silent Nighthawks were involved, although on this occasion it appeared that two were making occasional attempts to mate.

CHIMNEY SWIFT *Chaetura pelagica.* Uncommon in southern parts of the Clay Belt, rare in northern. In 1953 we saw them only on July 21, three at Judge, Ontario, about four miles north of Lake Timiskaming. Brother C. Larose told me he knew the bird at La Ferme, near Amos, Quebec. At a lumber camp of the Canadian International Paper Company on Lake Granet, Quebec, we saw eight on July 10, and again on July 11, and six on July 12 and 13, 1954. On July 21, 1954, we saw one at La Force on Lake Simard, Quebec, and three on July 23 and 24 at Gogama, Ontario. A. N. Boissonneau saw one at Cochrane on June 14, 1950.

RUBY-THROATED HUMMINGBIRD *Archilochus colubris.* Uncommon summer resident. In 1953 I saw one at Lake Blouin, Val d'Or, on August 18, and Mr. Baldwin saw another on August 25. In 1954 Mr. Baldwin saw one on Old Fort Point, Lake Timiskaming, Quebec, on July 19, and on July 22 we noted one at nearby Lake Laperrière.

F. Cowell has a specimen from Timmins. L. Hemphill saw one at Elsas on July 30, 1954, while we were working from that base. Snyder (1928) saw a few at Lake Abitibi.

BELTED KINGFISHER *Megaceryle alcyon alcyon.* Common summer breeding bird throughout the Clay Belt. In 1953 we found occupied nests at both Timmins and Kapuskasing. Nesting holes were noted in banks throughout the region.

YELLOW-SHAFTED FLICKER *Colaptes auratus.* Common breeder throughout the area. Nesting evidence from all parts of the region either by occupied nests or by the presence of unoccupied nesting cavities. Although we saw very few Flickers in the northeast corner of the Clay Belt I do not believe this necessarily indicates that they are less common there, as, for some reason, perhaps because we were traveling by canoe, we saw few woodpeckers of any species.

PILEATED WOODPECKER *Ceophloeus pileatus.* Apparently a rather scarce resident. We saw it on two occasions in the Hearst area, and heard one near Lake Waswanipi, Quebec. Drillings were noted throughout most of the region. Snyder (1928) reports very few at Lake Abitibi. Baillie and Harrington (1936) cite a nesting record from the vicinity of Kapuskasing.

YELLOW-BELLIED SAPSUCKER *Sphyrapicus varius.* Fairly common throughout most of the Clay Belt, including the northeast corner. We found occupied nests at Lake Granet, Quebec, and near Ville Marie, Quebec, all in poplars. Snyder (1928) records it as the most common woodpecker about Lake Abitibi, and mentions three occupied nests, and Baillie and Harrington (1936) cite several nesting records from Kapuskasing.

HAIRY WOODPECKER *Dendrocopus villosus.* Noted throughout the Clay Belt, except in the northeast corner. Not common. Snyder (1928) found the species "not numerous" about Lake Abitibi, but found a nest.

DOWNY WOODPECKER *Dendrocopus pubescens.* Status similar to that of the Hairy Woodpecker. Baillie and Harrington (1936) cite breeding records from Lake Abitibi and Kapuskasing.

ARCTIC THREE-TOED WOODPECKER *Picoides arcticus.* We saw one in black-spruce forest north of Remi Lake, Kapuskasing, on June 26, 1953, and another on August 25, 1953, Lake Blouin near Val d'Or. In 1954 we saw one in jack-pine forest about 5 miles east of Mt. Plamondon, Quebec, and one several miles south of Lake Waswanipi, Quebec, in black spruce on June 19. Snyder (1928) saw the species frequently at Lake Abitibi and found two nests. Baillie and Harrington (1936) cite a nesting record from Kapuskasing. F. Cowell has seen the species at Timmins.

AMERICAN THREE-TOED WOODPECKER *Picoides americanus americanus.* Snyder (1928) saw several at Lake Abitibi, and collected "a young bird not long out of the nest."

EASTERN KINGBIRD *Tyrannus tyrannus.* Seen commonly in 1953 until August 17, and similarly in 1954 until August 21, although we saw none in the northeast corner of the region. Mr. Baldwin found a nest near Kapuskasing in 1952, and Baillie and Harrington (1936) cite reported nesting at Uno Park north of Lake Timiskaming.

CRESTED FLYCATCHER *Myiarchus crinitus* Our only record of this species is of one we heard in an ash-elm woods on Dawson Point, Lake Timiskaming, July 21, 1953. A. N. Boissonneau saw one at Cochrane, June 9, 1951.

EASTERN PHOEBE *Sayornis phoebe.* Rare. We saw one near farm buildings at La Ferme, Amos, on August 4, 1953, and another at an abandoned lumber mill beside a pot-hole lake in jack-pine forest south of Matheson on September 3, 1953. On May 27, 1954, we saw and heard one on the northwest side of Lake Timiskaming. Snyder (1928) saw three at Lake Abitibi, and J. Coyne tells me he has seen a few at Gogama.

YELLOW-BELLIED FLYCATCHER *Empidonax flaviventris.* Probably well-distributed. In 1953 we noted it only near Camp 15 of the Spruce Falls Pulp and Paper Company south of Kapuskasing, where at least two birds were singing from the willow growth of a beaver pond. On June 8, 1954, I saw one at Lake Beauchamp near Amos. In a very extensive spruce-alder-sphagnum bog east of Mt. Plamondon, Quebec, we heard at least three a day on June 11, 12, 13, and 14, 1954. We heard one in a bog south of Lake Waswanipi, Quebec, on June 21 and, in various bogs about that lake we heard one each day on June 23, 24, 25, 26, and 28, 1954. Snyder (1928) noted single birds or pairs at several places on Lake Abitibi, and F. Cowell knows the species from Timmins.

ALDER FLYCATCHER *Empidonax traillii.* Common in alder bogs throughout the Clay Belt. F. Cowell has found a nest at Timmins.

LEAST FLYCATCHER *Empidonax minimus* At least as common as the Alder Flycatcher throughout the region. Snyder (1928) found a nest at Lake Abitibi.

EASTERN WOOD PEEWEE *Myiochanes virens.* I found a singing Peewee in a fir-birch woods on the shore of Lake Laperrière, just south of Ville Marie, Quebec, on July 20, 1954. This is probably about the northern limit of the species in the region.

OLIVE-SIDED FLYCATCHER *Nuttalornis borealis.* Despite familiarity with the song, I found this bird only twice. On July 26, 1954, we heard and saw one on the top of a dead spruce beside a small boggy, alder-shored pond in black-spruce forest near Gogama, and on August 2, 1954, another by Minisinakwa Lake, Gogama. Snyder (1928) found it "fairly common." Breeds at Lake Abitibi.

HORNED LARK *Eremophila alpestris.* I saw about 20 Horned Larks in a field near Amos on August 12, 1953. F. Cowell has seen it at Timmins.

TREE SWALLOW *Iridoprocne bicolor* Very common throughout the Clay Belt. We found nests at Timmins, Lake Abitibi, and near Kapuskasing. Baillie and Harrington (1936) cite, in addition, breeding evidence from Uno Park, north of Lake Timiskaming.

BANK SWALLOW *Riparia riparia.* Not well distributed. On July 4, 1953, we found a small nesting colony in a sand pit about five miles south on Chain of Lakes Road near Kapuskasing. We saw a flock of 20 near Hearst on June 2, 1954, and another of 15 at a sand pit near La Sarre, Quebec, on July 17, 1954.

BARN SWALLOW *Hirundo rustica.* Common throughout the Clay Belt around settlement of any sort. We even saw one about the Anglican mission in the Cree camp at the north end of Lake Waswanipi, Quebec, on June 28, 1954. I found an occupied nest in a barn near South Porcupine, Ontario, on June 19, 1953, and another at Hearst on June 2, 1954. Baillie and Harrington (1936) cite breeding evidence from Uno Park, north of Lake Timiskaming.

CLIFF SWALLOW *Petrochelidon pyrrhonota.* We saw one over the Harricanaw River near Amos on August 6, 1953. On June 9, 1954, we saw three around a barn on the outskirts of Amos, but could find no nests. On July 21, 1954, however, we saw 14 and found several nests under the eaves of a farmhouse a few miles south of Lake Simard, Quebec.

CANADA JAY *Perisoreus canadensis.* We saw these quiet fellows sparingly throughout the entire Clay Belt, often accompanied by well-grown young.

BLUE JAY *Cyanocitta cristata.* Not common. In 1953 we saw one near Timmins on the Mattagami River on June 21; one near Cochrane; one on Ile du Collège, Lake Timiskaming, on July 24; several at Mission Point on the same lake, July 28; one at Lake Blouin, Val d'Or, July 19 and 20; and we heard them frequently in the jack-pine forest south of Matheson between August 31 and September 8. In 1954 at New Liskeard we saw one on May 27 and two on May 29; at Rabbit Lake, 30 miles west of Hearst, two on June 4; at Gogama we saw two on July 25, three on July 26, and three on August 2; and at Elsas one on July 28, nine on July 29, and one on July 30. Snyder (1928) found the species rare at Lake Abitibi.

RAVEN *Corvus corax.* Common, although not numerous, throughout the Clay Belt. We saw 43 on the 250-mile canoe trip in the northeast corner of the region, or about 17 per 100 miles, and from one to six (commonly three) on any single day.

CROW *Corvus brachyrhynchos.* Found throughout the Clay Belt. Especialy numerous about farms and lumber camps. We saw only three on the canoe trip.

BLACK-CAPPED CHICKADEE *Parus atricapillus.* Fairly common, although not noted in the northeast corner of the region.

BOREAL CHICKADEE *Parus hudsonicus.* Slightly less common than the black-cap. We found it common at Lake Abitibi in 1953, and saw it feeding young on one occasion. We have also seen it on Ile du Collège (Lake Timiskaming), near Mt. Plamondon, Quebec, in the Waswanipi-Bell River area, at Lake Granet, at Gogama, and at O'Sullivan Lake (north of Geraldton).

RED-BREASTED NUTHATCH *Sitta canadensis.* Noted fairly commonly throughout the Clay Belt. Snyder (1928) found a nest at Lowbush.

WHITE-BREASTED NUTHATCH *Sitta carolinensis.* F. Cowell reports having seen this species at Timmins in summer.

BROWN CREEPER *Certhia familiaris.* We found this bird only near Lake Granet, Quebec, where we saw one on July 11, and another on July 12, 1954. Snyder (1928) saw a few at each camp he made on Lake Abitibi, and Baillie and Harrington (1936) cite a breeding record for Kapuskasing. F. Cowell has seen it at Timmins.

HOUSE WREN *Troglodytes aedon.* Uncommon summer resident. We found it at New Liskeard, Kapuskasing, Hearst, Amos, Ville Marie, and Gogama. Snyder (1928) found two nests in an "extensive brulé" at Lake Abitibi, and Baillie and Harrington (1926) cite a breeding record from Uno Park, north of Lake Timiskaming.

WINTER WREN *Troglodytes troglodytes.* A common songster throughout the forest, although seldom heard after the beginning of August.

BROWN THRASHER *Toxostoma rufum* We saw a single Thrasher in a willow in an old over-grown lumber camp clearing on the Makami River near Gogama on July 25, 1954. J. Coyne told me that he had seen several Thrashers at Gogama in the spring of 1954, although none in previous years.

CATBIRD *Dumetella carolinensis.* J. Coyne saw one at Gogama in late May, 1954. A. N. Boissonneau saw one at Cochrane on May 21, 1950.

ROBIN *Turdus migratorius.* Common breeder.

HERMIT THRUSH *Hylocichla guttata.* Common throughout the Clay Belt, noted usually by its song or call and seldom seen. Baillie and Harrington (1936) cite a nesting record for North Cobalt, near Lake Timiskaming.

OLIVE-BACKED THRUSH *Hylocichla ustulata.* Probably common. Seen only twice, once at the mouth of the Montreal River on Lake Timiskaming on July 31, 1953, and again on the Harricanaw River two miles south of Amos on August 6, 1953, although I heard it not infrequently. Snyder (1928) records the species as common at Lake Abitibi and he found a nest. Baillie and Harrington (1936) cite a breeding record from Kapuskasing.

VEERY *Hylocichla fuscescens.* Noted only in the Lake Timiskaming area. Near New Liskeard we heard and saw it as follows: May 27 (three), May 28 (three), May 29 (one), and May 30, 1954 (four). On July 20, 1954, we heard one singing at Lake Laperrière near Ville Marie.

It is known to breed as far north as Bigwood in the Sudbury District (Baillie and Hope, 1947), and a specimen collected at Rossport is believed to mark "the northern limits of range of this species in Ontario" (Baillie and Hope, 1943).

BLUEBIRD *Sialia sialis.* Not uncommon summer resident in farmed areas. In 1953 we observed one at Porcupine Lake, June 19; two on a telephone wire between tracks of the Ontario Northland Railway and a road through jack-pine forest near Nellie Lake, five miles west of Iroquois Fals on July 9; two at Brethour, Ontario (near Lake Timiskaming) on July 22; and, on a farm three miles south of Matheson on an esker in jack-pine country, one on August 31 and September 1, two on September 2. In 1954 at New Liskeard we saw three on May 29 and one on May 31, and one at Kapuskasing on May 31. At Hearst we saw one on June 4 and three on June 5, one at Senneterre on June 17, and one between Senneterre and Val d'Or on July 10. Snyder (1928) saw three pairs at Lake Abitibi, and calls one "a nesting pair."

GOLDEN-CROWNED KINGLET *Regulus satrapa.* Not common. In 1953 I noted only one female about six miles south of Matheson on September 2. In 1954 at Mt. Plamondon, Quebec, we saw two singing males on June 13, in the Waswanipi-Bell River area of the northeastern Clay Belt; we noted 13 between June 18 and July 9, at Lake Granet, Quebec, one on July 11 and 2 on July 13, and at Gogama we saw one on July 26. Snyder (1928) considers the species "rare" at Lake Abitibi.

RUBY-CROWNED KINGLET *Regulus calendula.* Very vocal, and evidently common, throughout the Clay Belt.

CEDAR WAXWING *Bombycilla cedrorum.* A very common, and obvious, summer resident throughout the region. Shows a preference for bogs, and shores of lakes and rivers. In 1953 we found four occupied nests at Kapuskasing, and in 1954 E. Nelson showed me a nest with five young in a red pine at Gogama.

GREAT SHRIKE *Lanius excubitor.* Transient, reported by K. Powell to be seen occasionally in early autumn and late winter at Cochrane. He found it especially frequent in early spring, 1954.

STARLING *Sturnus vulgaris.* A common breeder in all settled areas, but notably absent from the northeastern Clay Belt.

SOLITARY VIREO *Vireo solitarius.* Uncommon. Near Hearst we saw one on June 2 and another on June 3, 1954. In the vicinity of Mt. Plamondon, Quebec, we observed four on June 11, one on June 12, and two on June 13, 1954. In the Waswanipi-Bell River area of the northeastern Clay Belt we noted seven between June 18 and July 9, 1954. At Gogama we saw one on July 25, 1954, and near Elsas one on July 28 and another on July 29, 1954. Snyder (1928) saw a total of five at Lake Abitibi.

RED-EYED VIREO *Vireo olivaceus.* Common throughout the Clay Belt, preferring poplar woods, whereas the previous species was noted to be partial to coniferous or mixed forest. Sings persistently, even into September. Snyder (1928) found it nesting at Lake Abitibi.

PHILADELPHIA VIREO *Vireo philadelphicus.* The vireo of the wet alder thickets. We saw an adult feeding a young bird at the mouth of the Montreal River on Lake Timiskaming on July 31, 1953. In 1954 we saw one eight miles north of Hearst on June 3; three in an alder swamp near La Ferme, Amos, on June 8; a pair in an extensive alder thicket on the Bell River about three miles south of Cold Spring Rapids on July 6, and one on the Bell River just north of Rapides des Cèdres on July 9. Snyder (1928) found this species less common than the Red-eyed Vireo at Lake Abitibi. F. Cowell has seen it at Timmins.

BLACK AND WHITE WARBLER *Mniotilta varia.* Summer breeder, not one of the most common warblers. In 1953 we saw two at Lake Blouin, Val d'Or on August 18, 19, 20, and 21. In 1954 near New Liskeard we saw two on May 27 and one on May 30. Snyder (1928) records it as breeding at Lake Abitibi. A. N. Boissonneau saw one near Cochrane on May 10, 1951.

TENNESSEE WARBLER *Vermivora peregrina.* Not uncommon summer resident. In 1953 we saw one near Camp 15, Spruce Falls P. & P. Co., Kapuskasing River about 15 miles south of Kapuskasing on June 30. In 1954 we saw three at Forde Lake about 30 miles west of Hearst on June 4; we found them to be common in the Amos area on June 8; and in the Waswanipi - Bell River area of the northeastern Clay Belt we heard 29 between June 18 and July 9. The species is recorded from Lake Abitibi by Snyder (1928).

NASHVILLE WARBLER *Vermivora ruficapilla.* Common summer resident throughout the Clay Belt.

PARULA WARBLER *Parula americana.* Uncommon, but apparently widespread. Prefers the *zh-zh-zh-zh-zh-zheee* song. I heard the *zeeeeeeeeee-up* song on only two occasions. I believe I may have overlooked the species on several occasions before I noticed this feature. In 1954 I heard one eight miles north of Hearst on June 3; we saw one in black-spruce forest south of Lake Waswanipi, Quebec, on June 23, another on June 24; and at Lake Granet, Quebec, we heard one on July 11, two on July 12, and one on July 13. Snyder (1928) records it from Lake Abitibi.

YELLOW WARBLER *Dendroica petechia.* Common summer breeder throughout the Clay Belt.

MAGNOLIA WARBLER *Dendroica magnolia.* One of the most common warblers of the spruce forest. Snyder (1928) found it breeding at Lake Abitibi, and Baillie and Harrington (1936) cite a breeding record from Kapuskasing.

CAPE MAY WARBLER *Dendroica tigrina.* We saw one at Mt. Plamondon, Quebec, on June 11, 1954. Although I am unfamiliar with the songs of the species and did not attempt to identify it by ear, I do not think it is at all common in the Clay Belt. Snyder (1928) found it to be rare at Lake Abitibi.

BLACK-THROATED BLUE WARBLER *Dendroica caerulescens.* Uncommon. In 1953 we heard several singing by Ghost River near Lake Abitibi on June 19, and we also heard a few in the Kapuskasing area between June 22 and July 6. In 1954 I saw one in mature white-spruce forest at Forde Lake, 30 miles west of Hearst, on June 4, and at Mt. Plamondon, Quebec, we heard one on June 11 and two on June 13 in black spruce forest.

Baillie and Harrington (1936) cite a breeding record from Kapuskasing. F. Cowell saw one at Timmins in 1952.

MYRTLE WARBLER *Dendroica coronata.* Common throughout the region. I found a nest in a spruce beside Lake Beauchamp near Amos on June 8, 1954. Snyder (1928) found a nest at Lake Abitibi, and Baillie and Harrington (1936) cite a nesting record from Kapuskasing.

BLACK-THROATED GREEN WARBLER *Dendroica virens.* Fully as common as the Myrtle Warbler.

BLACKBURNIAN WARBLER *Dendroica fusca.* Uncommon. In 1954 in the New Liskeard area we saw two on May 27 and one on May 28; in the Waswanipi-Bell River area of the northeastern Clay Belt we saw or heard four between June 18 and July 9; and at Lake Granet, Quebec, we saw one on July 12. Snyder (1928) found it "rather rare" at Lake Abitibi. F. Cowell has seen the species near Timmins.

CHESTNUT-SIDED WARBLER *Dendroica pensylvanica.* Common in the New Liskeard area, but we did not find it farther north. Snyder (1928) took a single specimen at Lake Abitibi, and A. N. Boissonneau has seen the species at Cochrane.

BAY-BREASTED WARBLER *Dendroica castanea.* Not uncommon, although not numerous. We saw it in the following areas: Timmins, Lake Abitibi, Kapuskasing, Hearst, Amos, Plamondon, and the northeastern corner of the Clay Belt. Snyder (1928) saw young at Lake Abitibi, and Baillie and Harrington (1936) cite breeding evidence from near Kapuskasing.

PALM WARBLER *Dendroica palmarum* On July 10, 1953, I saw an adult (with a distinctly whitish belly) with two well-grown young in a tamarack-alder bog near Cochrane. There was at least one other pair in the bog. I also saw a few in early September, 1953, in jack-pine forest just south of Matheson. On June 28, 1954, I heard a song which I took to be of this species at Lake Waswanipi, Quebec.

OVEN-BIRD *Seiurus aurocapillus.* Common, and very vocal throughout the entire Clay Belt. Baillie and Harrington (1936) cite a breeding record from near Kapuskasing.

WATER-THRUSH *Seiurus noveboracensis.* Common. I found a nest at the base of a red-ozier dogwood, well concealed under a roof of twigs and litter, beside a lake about nine miles north of Hearst on June 2, 1954. Snyder (1928) gives breeding evidence for Lake Abitibi, and Baillie and Harrington (1936) cite breeding evidence from Kapuskasing.

CONNECTICUT WARBLER *Oporornis agilis.* Rare, but possibly present throughout the Clay Belt. I heard two singing in a wet black-spruce and poplar forest beside the Kapuskasing River near Camp 15, Spruce Falls Pulp and Paper Company, on June 30, 1953. In 1954 I collected a singing male in a black spruce flat seven miles north of Hearst on June 2, and we heard the song at Forde Lake, 30 miles west of Hearst, on June 4.

I recorded the song of the bird collected north of Hearst as "spik-a spaka- spik-a spaka- spic-a spaka- spik" without change of emphasis, rather like the song of a Yellow-throat. Snyder (1928) noted two singing males at Lake Nipigon and described the song as "a loud ca, chicka-chicka, chicka-chicka, chicka-chicka, reminding one of the song of the Maryland Yellow-throat." I occasionally heard what I believe was the Connecticut's song as far east as the Bell River between Rapides des Cèdres and Lake Mattagami, but on none of the occasions did I have time to seek out the bird to be certain it was not a Yellow-throat. Snyder (1928) reported that both he and Mr. Baillie heard the Connecticut Warbler singing in a swamp near Lowbush. Baillie (1950) reports an adult seen "attending a fully grown young 25 miles west of Cochrane" on August 9.

From south of the Clay Belt, Baillie and Harrington (1936) report that a pair was seen feeding a young bird near Agawa, Algoma District, on August 17, 1918, by M. J. Magee, and Baillie and Hope (1943) noted a few singing males in "spruce bogs" at Amyot in the Algoma District. Northward, Todd (1943) has "secured a breeding specimen" from the James Bay area. From west of the Clay Belt I have mentioned Snyder's Lake Nipigon record. Farther west in Ontario Snyder (1953) remarks that the "species appears to be strictly a bird of the black spruce habitat, preferring those areas where the trees are well developed but the stand not dense," a description that fits well the spot north of Hearst where I collected the previously mentioned singing male.

MOURNING WARBLER *Oporornis philadelphia.* Not common, but found throughout the Clay Belt in clearings, burned areas, etc. I did not find it in the Geraldton area, but we were there only late in the season.

YELLOW-THROAT *Geothlypis trichas.* Common in marshes and bogs throughout the Clay Belt.

WILSON'S WARBLER *Wilsonia pusilla.* I saw one near Amos on August 10, 1953, and Mr. Baldwin saw one in the same place on August 13. Snyder (1928) saw several at Lake Abitibi, and secured breeding evidence.

CANADA WARBLER *Wilsonia canadensis.* Not uncommon throughout the Clay Belt. Again, I have no records from the Geraldton area.

AMERICAN REDSTART *Setophaga ruticilla.* Fairly common throughout the Clay Belt, Snyder (1928) says it is "known to breed" at Lake Abitibi.

HOUSE SPARROW *Passer domesticus domesticus.* Common about settlement, but absent elsewhere.

BOBOLINK *Dolichonyx oryzivorus.* Becoming established, at least in the central Clay Belt. Around Lake Timiskaming we saw two on July 22, 1953, near New Liskeard; three on July 22, 1954, near Fabre, Quebec (extreme southern end of Clay Belt); and at Lake Laperrière near Ville Marie on July 19, 1954, one, July 20 (two), 21 (two) and 22 (two). On June 19, 1953, I saw two singing males in a farm field near South Porcupine, and Mr. Baldwin told me of hearing some at nearby Bob's Lake a week earlier. On July 13, 1953, we saw a singing male in a field near Lillabelle Lake north of Cochrane where Dr. D. B. O. Savile (1950) had seen one in 1949. A. N. Boissonneau told us that they have been there since at least 1949. Brother C. Larose reports them as a summer resident at La Ferme near Amos, although I have not seen any there.

The Bobolink is known from north of the Clay Belt at Moose Factory. Baillie and Harrington (1936) report one shot there, and Baillie (1951) reports two males and a female observed.

EASTERN MEADOWLARK *Sturnella magna.* Baillie and Harrington (1936) report it "northward rarely as far at least as Englehart, near Heaslip in Temiskaming District." Baillie (1925) reports that he and L. L. Snyder heard the Eastern Meadowlark at Englehart. K. Powell reports one from near Timmins about 1950. F. Cowell saw one there on May 11, 1954. J. Coyne saw at least two in the clearing at Gogoma during May 1954. The N.M.C. has a specimen taken well north of the Clay Belt at Eastmain, Quebec, in November, 1946.

RED WING *Agelaius phoeniceus.* Fairly common throughout the Clay Belt, even in areas as remote as the northeastern corner. Although some residents told us that it had appeared only within the past 20 years or less, others insisted it was no less common 30 years ago, and the report of the latter is probably more reliable. We found nests at Lake Abitibi, and Baillie and Harrington (1936) cite a nesting record from Timmins.

RUSTY BLACKBIRD *Euphagus carolinus.* Found in small numbers in suitable habitats. Snyder (1928) found it breeding at Lake Abitibi.

BRONZED GRACKLE *Quiscalis versicolor.* Fairly common, even in the northeast corner. Noted with young at Kapuskasing. Snyder (1928) found nests at Lake Abitibi.

COWBIRD *Molothrus ater*. On May 29, 1954, we saw three near New Liskeard, and on June 17 we saw one at Senneterre. J. Coyne considers Cowbirds to be fairly common in flocks of Starlings at Gogama. F. Cowell has seen the species at Timmins.

SCARLET TANAGER *Piranga olivacea*. We saw a female or immature in a poplar grove by the mouth of the Montreal River on Lake Timiskaming on July 31, 1953. On May 30, 1954, we saw a male in white-pine forest only about four miles farther north. Baillie and Harrington (1936) report that Leonard Berry saw this species at Timmins on June 3, 1936.

ROSE-BREASTED GROSBEAK *Pheucticus ludovicianus*. On July 30, 1953, I saw a female in a Norway-spruce windbreak on the provincial experimental farm at New Liskeard. Snyder (1928) reports that J. R. Dymond saw a male at the mouth of the Ghost River on Lake Abitibi on July 8.

EVENING GROSBEAK *Hesperiphona vespertina*. I found this species considerably more rare than I had expected, being familiar with it as a fairly conspicuous species of the forest not far south of the Clay Belt (Smith, 1952). Although I thought I heard the call note on four occasions in 1954, the only sight record I have is one male seen about six miles west of Elsas on July 28, 1954. J. Coyne told me that they were common at Gogama in winter, and that he saw a few during the summer. F. Cowell reported the bird to be not rare at Timmins in the winter, but very rare in the summer.

PURPLE FINCH *Carpodacus purpureus*. One of the most common birds in the Clay Belt, very vocal until July.

PINE GROSBEAK *Pinicola enucleator*. Reported by various residents as not uncommon during the winter. Mr. W. Earl Godfrey told me of seeing a small group on August 11, 1953, along the Trans-Canada Highway between Longlac and Hearst. Snyder (1928) saw two at Lake Abitibi during the summer.

PINE SISKIN *Spinus pinus*. Noted in all portions of the Clay Belt except the Geraldton area. Not common except during June, 1953, when they were much in evidence. I found three nests on June 24, 1953, at Kapuskasing.

AMERICAN GOLDFINCH *Spinus tristis*. Common throughout the Clay Belt, but not noted in the northeastern corner.

WHITE-WINGED CROSSBILL *Loxia leucoptera*. An uncommon summer resident; flocks reported by several observers. We saw a flock of about 20 at Mt. Plamondon, Quebec, on June 13, and six on June 14, 1954. On June 18 we saw another flock of 20 south of Lake Waswanipi, Quebec, and a flock of ten on June 19, 1954. On July 7, 1954, we saw a flock of 20 at Taibi Point on Bell River south of Lake Mattagami. On July 26, 1954, we saw five near Gogama.

LARK BUNTING *Calamospiza melancorys*. Snyder (1928) cites a published record of a specimen collected at Lowbush in summer.

SAVANNAH SPARROW *Passerculus sandwichensis*. The most common sparrow about farms, lakesides, and river banks in the entire Clay Belt. In the northeastern corner we found it at only one place: there were two singing males in the clearing beside the Indian camp at the Hudson's Bay Company's Waswanipi post. Godfrey (1949) noted a similar occurrence at the Company's Mistassini post. He also found a few in muskeg areas as we did in the Clay Belt. However, on the trip to the northeastern corner, we actually investigated no muskeg.

VESPER SPARROW *Pooecetes gramineus*. Uncommon. We saw at least one in a farm field at La Ferme, near Amos, between August 4 and 17, 1953, and several near Matheson in September 1953. On July 17, 1954, we saw one singing in a field near La Sarre. Snyder (1928) found the species at two locations on Lake Abitibi. F. Cowell finds it common around Timmins.

SLATE-COLORED JUNCO *Junco hyemalis*. Common throughout the Clay Belt, noted with young at Lake Abitibi. Baillie and Harrington (1936) cite nesting records from Kapuskasing, Timmins, and North Cobalt.

TREE SPARROW *Spizella arborea*. Transient. Reported from Timmins by F. Cowell, and from Cochrane by A. N. Boissonneau. Snyder (1928) collected a male (probably injured) at Lake Abitibi on June 21.

CHIPPING SPARROW *Spizella passerina*. Noted throughout the Clay Belt, except in the northeastern corner, both in the forest and about settlement. We found nests at Kapuskasing and Elsas, and dependent young at Lake Abitibi.

WHITE-THROATED SPARROW *Zonotrichia albicollis*. Certainly one of the most conspicuous birds of the boreal forest. We found nests near Cochrane and at Ile du Collège, Lake Timiskaming. One of the Cochrane nests was three feet from the ground in a stunted black spruce. Snyder (1928) reports that it breeds at Lake Abitibi.

SONG SPARROW *Melospiza melodia*. Common throughout the Clay Belt in farms, natural clearings, lake-shore thickets, river banks, old burns, and similar habitat. Somewhat less common than the Savannah Sparrow. We did not see them on the canoe trip through the northeastern corner until we reached Island Rapids on the Bell River on July 6, 1954, when we saw three singing males. We saw another on July 7. Their habitat there was alder thickets facing small, grassy, rock islands or points.

I collected an immature bird at Kapuskasing, August 6, 1954. We found a nest by Lake Minisinakwa a few miles from Gogama on July 25, 1954. Snyder (1928) found a nest at Lake Abitibi. Baillie and Harrington (1936) report a breeding record from Kapuskasing.

LINCOLN'S SPARROW *Melospiza lincolnii.* We found three pairs at the edge of a spruce-larch-alder bog beside an open unused high-grass field near Cochrane between July 6 and July 20, 1953. In 1954 we saw one singing male in a spruce sphagnum bog near Amos. Snyder (1928) found several at Lake Abitibi and saw an adult feeding young. Baillie and Harrington (1936) cite a breeding record from Kapuskasing.

SWAMP SPARROW *Melospiza georgiana.* Common to swamps and marshes, especially cattail marshes, throughout the Clay Belt.

SNOW BUNTING *Plectrophenax nivalis.* Transient. Reported by several observers.

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THE COMPARATIVE NUMBER OF SPECIES OF AMPHIBIANS IN CANADA AND OTHER COUNTRIES

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WHEN ONE is studying and collecting the amphibians of Canada or those of certain sections in Canada he finds of great interest the world distribution of the genus or species represented by the specimen at hand. It is therefore necessary to consult scientific books or periodicals as well as works of natural history in order to get the desired information. This sometimes requires considerable time, especially if the genus has a wide distribution. Accordingly, this list, written by an amateur, has been compiled to serve as a time-saving aid.

The total number of species of amphibians throughout the world is probably about 2,900, 2,600 of which are frogs, 225 salamanders and 75 caecilians. In addition to this may be added 500 to 1000 subspecies and over 1000 synonyms. Although the literature has been carefully checked, the figures given are more an estimate than an actual count. It will be noted that there is a great number of subspecies in relation to the full species in North America and Europe, where the amphibians are well known, than in other continents. When the amphibians are better known in South America, Africa, and elsewhere, many full species will very likely be reduced to subspecific status. For examples of differences of opinion see Wolf (1936) and Ahl (1931) on the number of species of *Rhacophorus* alone, and also Taylor (1920-1923) and Inger (1954) on Philippine amphibia.

In this article Mexico and Central America are treated as part of South America. This is not in accord with general procedure. However, the genera and species of Central America are, I believe, generally more closely related to those of South America than to those found north of Mexico. Asia includes New Guinea and the area east to the Fiji Islands. The genera and species inhabiting New Guinea appear somewhat more closely related to those of Australia than to those of Asia, but as Van Kampen (1923) included New Guinea along with Java, Borneo and Sumatra, I have followed his method.

In Canada we have a good representation with regard to the families as follows (names in brackets are those genera found in Canada): Ascaphidae (*Ascaphus*) are found in North America and New Zealand, the only other genus being *Leiopelma* of the latter country. Pelobatidae (*Scaphiopus*) are found in North America and Mexico, in Europe, most of Asia, North Africa and the Seychelles Islands. *Scaphiopus* is not found in the Old World. Bufonidae (*Bufo*) are found in North, Central and South America, Europe and most of Asia and Africa, but are not found in Madagascar, Polynesia or Australia. Hylidae (*Hyla, Pseudacris, Acris*) are found in North, Central and most of South America, Europe, Asia as far south as Burma and Arabia, also North Africa, apparently absent from Malay Archipelago but found in Australia, New Guinea and Solomon Islands. *Pseudacris* and *Acris* are not found in the Old World. Ranidae (*Rana*) are found in North, Central and South America to and including northern Brazil, Africa, Europe, Asia to northern Australia. It will be seen that the three common genera *Bufo, Hyla, Rana* of their respective families Bufonidae, Hylidae and Ranidae have a wide distribution and contain about one third of all the species of Salientia known. The Caudata do not have quite so interesting a distribution. Proteidae (*Necturus*) are found in North America and Europe. *Necturus* is limited to North America and the only other genus is apparently confined to Europe. Ambystomidae (*Ambystoma, Dicamptodon*) are found only in the New World ranging over North America and Mexico, there being three genera limited to Mexico and one other to United States. Salamandridae (*Taricha, Diemictylus*) range over North America, Mexico, Europe, north Africa and Asia as far south as Palestine and northern India. Some of the Old World species closely resemble our own. Plethodontidae (*Desmognathus, Plethodon, Hemidactylium, Ensatina, Gyrinophilus, Aneides, Eurycea*) range over North, Central and well into South America. Only one genus is found in the Old World, it being confined to southern Europe.

In regard to the frog families which do not range into Canada the following summary may be of interest. Pipidae are South American and African. Discoglossidae are European, north African, central Asian and Japanese. Microhylidae are found in United States, Central and South America, Africa, a large part of Asia and also Australia. Rhacophoridae are confined to Africa and Asia but are not found in New Guinea. Brachycephalidae and Centrolenidae are confined to Central and South America, being found from Nicaragua to and including northern Peru and Brazil. Leptodactylidae are found from Texas to southern South America and again in Australia and New Guinea. It seems doubtful if the genera of Leptodactylidae form a natural family or if the Australian and South American forms have evolved independently from some bufonid ancestor. It appears that where the genera of Bufonidae are least common (*Bufo* excepted in some cases) there exists a variety of leptodactylid genera. For example, there are only one or two genera of Bufonidae found in Central and South America but there are over thirty genera of Leptodactylidae. In Australia there is a complete absence of Bufonidae while there are over a dozen genera of Leptodactylidae. It is interesting to note that Hylidae, in most cases, are able to live in the same general area as Bufonidae or Leptodactylidae, there being about twenty-five genera of Hylidae in South America and two in Australia and New Guinea. It will be noted, however, that Rhacophoridae and Hylidae cross ranges only in eastern Asia (Burma to Japan) and this suggests perhaps a competition between the families. With Rhacophoridae there has also been some doubt about the species forming a natural group or whether or not the Asian forms arose independently from Asian ranids and African forms from African ranids. It is significant that *Rana* is the only genus of Ranidae found in both the Old and New World, and that nearly a score of ranid genera are found in Africa, all being endemic but differing considerably. Over a dozen genera are found in Asia, all endemic, but they do not differ from one another so greatly as do the African ones. In Rhacophoridae we have somewhat the same situation, there being two well-known genera in Asia, closely related, whereas in Africa there are fifteen or twenty genera, depending on the author, and a number of these differ considerably. Only *Rhacophorus,* which is found in Asia, appears in Africa where it is confined to Madagascar. *Phrynomerus* of Microhylidae is sometimes given family rank (Parker, 1931) on the strength of its intercalary cartilage or bone between the terminal phalanx of the digits as in Rhacophoridae, Hylidae and Centrolenidae. This cartilage is not found in Ranidae, Microhylidae, Leptodactylidae or Bufonidae. Nieden (1926) did not place *Dendrobates* and allied genera in Brachycephalidae, and Parker (1934) used Atelopodidae as the family name. Heleophryne has been placed at times in Bufonidae, Ranidae, Microhylidae and Leptodactylidae. If it is a leptodactylid, then it is the only genus known from Africa, and if so, it appears to be another case of parallel evolution from a bufonid ancestor.

The references given in this article represent a very small percentage of the literature available. However, most of the references are of great importance and many works contain good bibliographies. In most cases, copies are held in the Library of the National Museum of Canada and may be consulted there.

The following bibliography of checklists for countries for which they are available includes the approximate number of species treated in each work. In addition I have gathered together from numerous references figures for the number of families, genera and species on each continent. These may be of interest to those who wish to compare families or genera in different continents. When it is all summed up, we have a good variety of amphibians to conserve, study and collect here in Canada.

I wish to thank my friend, Dr. Sherman Bleakney, of the National Museum of Canada, and others, for co-operation during the writing of this article.

SUMMARY OF FAMILIES, GENERA AND NUMBER OF SPECIES BY CONTINENTS

The listing of the genera is to show the composition of each family but probably no two authors agree entirely as to the validity of the genera contained in a family. A number of generic names proposed for species already described have not been included. Generic names synonymized have also been excluded. The author and year of publication of each genus may be found in Neave (1939-1950) which contains a list of generic and subgeneric names up to 1945. For names from 1945 to 1954 the Zoological Record should be consulted.

SOUTH AMERICA
(INCLUDING CENTRAL AMERICA)
(1259 SPECIES)

APODA (CAECILIANS) 46 species.

Caeciliidae (46): *Caecilia*, 16; *Chthonerpeton*, 3; *Gymnopis*, 13; *Rhinatrema*, 6; *Siphonops*, 5; *Typhlonectes*, 3.

CAUDATA (SALAMANDERS) 106 species.

Sirenidae (1): *Siren*, 1.

Ambystomidae (17): *Ambystoma*, 11; *Bathysiredon*, 1; *Rhyacosiredon*, 4; *Siredon*, 1.

Salamandridae (3): *Diemictylus*, 2; *Taricha*, 1.

Plethodontidae (85): *Aneides*, 1; *Batrachoseps*, 1; *Bolitoglossa*, 20; *Chiropterotriton*, 10; *Ensatina*, 1; *Magnadigita*, 18; *Oedipina*, 13; *Parvimolge*, 1; *Pseudoeurycea*, 15; *Thorius*, 5.

SALIENTIA (FROGS) 1107 species.

Pipidae (5): *Pipa*, 5.

Pelobatidae (3): *Scaphiopus*, 3.

Rhinophrynidae (1): *Rhinophrynus*, 1.

Bufonidae (81): *?Allophryne*, 1; *Bufo*, 80.

Leptodactylidae (467): *Basanitia*, 2; *Batrachophrynus*, 4; *Calyptocephala*, 2; *Ceratophrys*, 17; *Craspedoglossa*, 2; *Crossodactylodes*, 1; *Crossodactylus*, 5; *?Ctenocranius*, 1; *Cycloramphus*, 4; *Edalorhina*, 2; *Eleutherodactylus*, 227; *Elosia*, 7; *Engystomops*, 5; *Eusophus*, 15; *Holoaden*, 1; *Hylopsis*, 1; *Hylorina*, 1; *Lepidobatrachus*, 1; *Leptodactylus*, 60; *Limnomedusa*, 2; *Lithodytes*, 2; *Macrogenioglottus*, 1; *Megaelosia*, 1; *Microbatrachylus*, 11; *Odontophrynus*, 3; *Phrynanodus*, 1; *Physalaemus*, 13; *Pleurodema*, 14; *Pseudopaludicola*, 6; *Syrrhopus*, 22; *Teletrema*, 1; *Telmatobius*, 24; *Telmatobufo*, 1; *Tomodactylus*, 4; *Zachaenus*, 3.

Hylidae (388): *Acris*, 1; *Acrodytes*, 3; *Agalychnis*, 6; *Amphignathodon*, 1; *Amphodus*, 3; *Anotheca*, 1; *Aparasphenodon*, 1; *Aplastodiscus*, 1; *Bradymedusa*, 2; *Cerathyla*, 6; *?Chorophilus*, 2; *Corythomantis*, 3; *Cryptobatrachus*, 2; *Diaglena*, 2; *Flectonotus*, 1; *Garbeana*, 1; *Gastrotheca*, 21; *Hemiphractus*, 2; *Hyla*, 282 (includes seven species sometimes placed in *Hylella*); *Hyloscirtus*, 1; *Nototheca*, 1; *Phyllomedusa*, 25; *Plectrohyla*, 7; *Pseudis*, 8; *Pseudohyla*, 1; *Pternohyla*, 1; *Ptychohyla*, 1; *Trachycephalus*, 1; *Triprion*, 1.

Centrolenidae (22): *Centrolene*, 4; *Cochranella*, 17; *Teratohyla*, 1?.

Brachycephalidae (90): *Atelopus*, 27; *Brachycephalus*, 1; *Dendrobates*, 23; *Dendrophryniscus*, 1; *Geobatrachus*, 1; *Hyloxalus*, 7; *Nobella*, 2; *Oreophrynella*, 2; *Phyllobates*, 25; *Rhinoderma*, 1.

Microhylidae (39): *Arcovomer*, 1; *Chiasmocleis*, 11; *Ctenophryne*, 1; *Dasypops*, 1; *Dermatonotus*, 1; *Elachistocleis*, 1; *Gastrophryne*, 2; *Glossostoma*, 2; *Hamptophryne*, 1; *Hyophryne*, 1; *Hypopachus*, 12; *Myersiella*, 1; *Otophryne*, 1; *Relictivomer*, 1; *Stereocyclops*, 1; *Synapturanus*, 1.

Ranidae (11): *Rana*, 11.

NORTH AMERICA
(NORTH OF MEXICO)
(143 SPECIES)

CAUDATA (SALAMANDERS) 83 species.

Cryptobranchidae (1): *Crytobranchus*, 1.

Proteidae (3): *Necturus*, 3.

Sirenidae (3): *Pseudobranchus*, 1; *Siren*, 2.

Ambystomidae (12): *Ambystoma*, 10; *Dicamptodon*, 1; *Rhyacotriton*, 1.

Salamandridae (5): *Diemictylus*, 2; *Taricha*, 3.

Amphiumidae (1): *Amphiuma*, 1.

Plethodontidae (58): *Aneides*, 5; *Batrachoseps*, 4; *Desmognathus*, 9; *Ensatina*, 1; *Eurycea*, 6; *Gyrinophilus*, 3; *Haideotriton*, 1; *Hemidactylium*, 1; *Hydromantes*, 1; *Leurognathus*, 1; *Manculus*, 1; *Plethodon*, 19; *Pseudotriton*, 2; *Stereochilus*, 1; *Typhlomolge*, 1; *Typhlotriton*, 2.

SALIENTIA (FROGS) 60 species.

Ascaphidae (1): *Ascaphus*, 1.

Pelobatidae (4): *Scaphiopus*, 4.

Bufonidae (13): *Bufo*, 13.

Leptodactylidae (5): *Eleutherodactylus*, 2; *Leptodactylus*, 1; *Syrrhopus*, 2.

Hylidae (20): *Acris*, 1; *Hyla*, 13; *Pseudacris*, 6.

Microhylidae (2): *Hypopachus*, 1; *Gastrophryne*, (=*Microhyla*) 1.

Ranidae (15): *Rana*, 15.

EUROPE
(41 SPECIES)

CAUDATA (SALAMANDERS) 19 species.

Hynobidae (1): *Hynobius*, 1.

Salamandridae (16): *Chioglossa*, 1; *Euproctus*, 3; *Pleurodeles*, 1; *Salamandra*, 2; *Salamandrina*, 1; *Triturus*, 8.

Plethodontidae (1): *Hydromantes*, 1.

Proteidae (1): *Proteus*, 1.

SALIENTIA (FROGS) 22 species.

Discoglossidae (5): *Alytes*, 2; *Bombina*, 2; *Discoglossus*, 1.

Pelobatidae (4): *Pelobates*, 3; *Pelodytes*, 1.

Bufonidae (3): *Bufo*, 3.

Hylidae (1): *Hyla*, 1.

Ranidae (9): *Rana*, 9.

ASIA
(708 SPECIES)

APODA (CAECILIANS) 8 species.

Caeciliidae (8): *Gegenophis*, 1; *?Herpele*, 1; *Ichthyophis*, 2; *Uraeotyphlus*, 4.

CAUDATA (SALAMANDERS) 51 species.

Hynobidae (30): *Batrachuperus*, 6; *Hynobius*, 20; *Onychodactylus*, 2; *Pachypalaminus*, 1; *Ranodon*, 1.

Cryptobranchidae (1): *Megalobatrachus*, 1.

Salamandridae (20): *Cynops*, 4; *Hypselotriton*, 1; *Martensiella*, 2; *Neurergus*, 1; *Pachytriton*, 2; *Paramesotriton*, 1; *Salamandra*, 3; *Triturus*, 3; *Tylototriton*, 3.

SALIENTIA (FROGS) 649 species.

Discoglossidae (4): *Barbourula*, 1; *Bombina*, 2; *Discoglossus*, 1.

Pelobatidae (45): *Aelurophryne*, 5; *Leptobachella*, 2; *Megophrys*, 26; *Nesobia*, 1; *Pelobates*, 2; *Pelodytes*, 1; *Scutiger*, 6; *Vibrissaphora*, 2.

Bufonidae (77): *Ansonia*, 3; *Bufo*, 50; *Cacophryne*, 1; *Ophryophryne*, 1; *Pedostibes*, 12; *Pelophryne*, 8; *Pseudobufo*, 2.

Leptodactylidae (6): *Crinia*, 1; *Lechriodus*, 4; *Limnodynastes*, 1.

Hylidae (52): *Hyla*, 46; *Nyctimystes*, 6.

Microhylidae (129): *Aphantophryne*, 1; *Asterophrys*, 15; *Barygneys*, 2; *Calluella*, 4; *Chaperina*, 1; *Colpoglossus*, 2; *Cophixalus*, 10; *Gastrophrynoides*, 1; *Genyophryne*, 1; *Glyphoglossus*, 1; *Kalophrynus*, 4; *Kaloula*, 13; *Melanobatrachus*, 1; *Metaphrynella*, 2; *Metopostira*, 3; *Microbatrachus*, 1; *Microhyla*, 17; *Oreophryne*, 15; *Otophryne*, 1; *Phrynella*, 1; *Ramanella*, 8; *Sphenophryne*, 9; *Uperodon*, 2; *Xenobatrachus*, 14.

Ranidae (225): *Altirana*, 1; *Batrachylodes*, 2; *Ceratobatrachus*, 1; *Cornufer*, 9; *Discodeles*, 3; *Micrixalus*, 9; *Nannobatrachus*, 3; *Nannophrys*, 3; *Nyctibatrachus*, 4; *Ooeidozyga*, 7; *Palmatorappia*, 1; *Platymantis*, 10; *Rana*, 160; *Simomantis*, 1; *Staurois*, 11.

Rhacophoridae (111): *Rhacophorus*, 23; *Philautus*, 88.

AUSTRALIA AND NEW ZEALAND
(82 SPECIES)

SALIENTIA (FROGS) 82 species.

Ascaphidae (=Leiopelmidae) (3): *Leiopelma*, 3.

Leptodactylidae (54): *Adelotus*, 1; *Crinia*, 10; *Cyclorana*, 7; *Glauertia*, 3; *Heleioporus*, 8; *Lechriodus*, 1; *Limnodynastes*, 7; *Metacrina*, 1; *Mixophyes*, 1; *Myobatrachus*, 1; *Notaden*, 2; *Philoria*, 2; *Pseudophryne*, 8; *Uperoleia*, 2.

Hylidae (21): *Hyla*, 21.

Microhylidae (3): *Cophixalus*, 1; *Stenophryne*, 2.

Ranidae (1): *Rana*, 1.

AFRICA
(INCLUDING MADAGASCAR AND SEYCHELLES)
(805 SPECIES)

APODA (CAECILIANS) 21 species.

Caeciliidae (21): *Boulengerula*, 4; *Geotrypetes*, 2; *Herpele*, 3; *Hypogeophis*, 6; *Idiocranium*, 1; *Schistometopum*, 2; *Scolecomorphus*, 3.

CAUDATA (SALAMANDERS) 4 species.

Salamandridae (4): *Pleurodeles*, 1; *Triturus*, 2; *Salamandra*, 1.

SALIENTIA (FROGS) 780 species.

Pipidae (12): *Hymenochirus*, 4; *Pseudhymenochirus*, 1; *Xenopus*, 7.

Discoglossidae (1): *Discoglossus*, 1.

Pelobatidae (4): *Nesomantis*, 1; *Pelobates*, 1; *Sooglossus*, 2.

Bufonidae (64): *Bufo*, 50; *Didynamipus*, 1; *Heleophryne*, 4 (considered by some authors as entitled to family status, Heleophrynidae); *Nectophrynoides*, 1; *Nectophryne*, 5; *Pseudophryne*, 1; *Werneria*, 1; *Wolterstorffina*, 1.

Hylidae (2): *Hyla*, 2?.

Microhylidae (63): *Anodonthyla*, 2; *Breviceps*, 17; *Callulina*, 1; *Cophyla*, 1; *Dyscophus*, 6; *Fichteria*, 1; *Hoplophryne*, 2; *Mantipus*, 5; *Parhoplophryne*, 1; *Platyhyla*, 1; *Platypelis*, 16; *Plethodontohyla*, 1; *Probreviceps*, 2; *Phrynomerus*, 3; *Rhombophryne*, 1; *Spelaeophryne*, 1; *Stumpffia*, 2.

Ranidae (206): *Anhydrophryne*, 1; *Arthroleptis*, 53; *Arthroleptides*, 2; *Astylosternus*, 1; *Cardioglossa*, 7; *Cacosternum*, 4; *Dimorphognathus*, 1; *Gampsosteonyx*, 1; *Hemisus*, 2; *Leptodactylodon*, 2; *Nyctibates*, 1; *Petropedetes*, 6; *Phrynobatrachus*, 34; *Phrynodon*, 1; *Phrynopsis*, 1; *Pseudohemisus*, 8; *Rana*, 75; *Scaphiophryne*, 1; *Schoutedenella*, 3; *Scotobleps*, 1; *Trichobatrachus*, 1.

Rhacophoridae (428): *Afrixalus*, 36; *Callixalus*, 1; *?Cassiniopsis*, 1; *Chiromantis*, 12; *Chryptothylax*, 1; *Chrysobatrachus*, 1; *Dendrobatorana*, 1; *Gephyromantis*, 4; *Hylambates*, 11; *Hyperolius*, 204; *Kassina*, 8; *?Kassinula*, 1; *Leptopelis*, 53; *Mantella*, 9; *Mantidactylus*, 42; *Megalixalus*, 1; *Mocquardia*, 3; *Rhacophorus*, 35; *?Semnodactylus*, 1; *Trachymantis*, 2; *?Tornierella*, 1.

CATALOGUES, MONOGRAPHS, COMPILATIONS AND CHECKLISTS OF AMPHIBIANS ARRANGED GEOGRAPHICALLY

Universal

Ahl, E. 1931. Das Tierreich, Anura, III, Polypedatidae. Berlin, Walter de Gruyter and Co., 478 p. (About 532 species treated. Compilation up to year 1930)

Boulenger, G. A. 1895. A synopsis of the genera and species of apodal batrachians, with description of a new genus and species (*Bdellophis vittatus*). Proc. zool. Soc. Lond., p. 401-414.

Boulenger, G. A. 1882. Catalogue of the Batrachia Salientia s. Ecaudata, in the collection of the British Museum. 2d ed., London, Brit. Mus. 503 p. (About 800 species recognized)

Boulenger, G. A. 1882. Catalogue of the Batrachia Gradientia s. Caudata and Batrachia Apoda, in the collection of the British Museum. London, Brit. Mus. 127 p. (About 101 species salamanders, 32 species caecilians recognized)

Dunn, E. R. 1926. The salamanders of the family Plethodontidae. North Hampton, Mass., Smith College. 441 p. (About 86 species and subspecies recognized)

Gadow, H. 1901. Amphibia and reptiles. Cambridge Natural History, v. 8. London, Macmillan. 688 p.

Neave, S. A. 1939-1950. Nomenclator Zoologicus. 5 v. London, Zoological Society. (Contains generic and subgeneric names up to 1945)

Nieden, F. 1913. Das Tierreich, Gymnophrona (Amphibia Apoda). Berlin, R. Friedlander und Sohn. 32 p. (About 56 species recognized)

Nieden, F. 1923. Das Tierreich, Anura, I, Subordo Aglossa und Phaneroglossa. Berlin, Walter de Gruyter and Co. 584 p. (About 820 species recognized. Covers fully the families Pipidae, Discoglossidae, Pelobatidae, Bufonidae, Hylidae, Cystignathidae, up to year 1913)

Nieden, F. 1926. Das Tierreich, Anura, II, Engystomatidae. Berlin, Walter de Gruyter and Co. 110 p. (About 182 species recognized. Deals with genera *Rhinoderma*, *Brachycephalus*, *Oreophrynella*, *Atelopus*, which are now placed in Brachycephalidae. Also *Scaphiophryne*, *Pseudohemisus*, *Hemisus*, *Cacosternum*, *Phrynomantis*, some of which are now placed in Ranidae, and *Didynamipus* now placed in Bufonidae)

Noble, G. K. 1931. The biology of Amphibia. New York, McGraw-Hill, 576 p. (States that at the time there were probably 1900 living species)

Parker, H. W. 1934. A monograph of the frogs of the family Microhylidae. London, Brit. Mus. 208 p.

Zoological Record. Amphibia and Reptilia Section. Zoological Society, London, England. Published yearly. Probably the best single source of information. Endeavors to list all literature, new genera and species.

North America

Bishop, S. S. 1943. Handbook of salamanders. Ithaca, Comstock. 555 p.

Boulenger, G. A. 1920. A monograph of the American frogs of genus *Rana*. Proc. Amer. Acad. Arts Sci. 55: 413-480. (About 21 species recognized)

Cope, E. D. 1889. The Batrachia of North America. Bull. U.S. nat. Mus. 34: 525.

Logier, E. B. S., and G. C. Toner. 1955. Check-list of amphibians and reptiles of Canada and Alaska. Cont. R. Ont. Mus. Zool. Palaeont. 41: 88. (About 44 forms recognized)

Schmidt, K. P. 1953. A checklist of North American amphibians and reptiles. 6th ed. Chicago, Univ. Chicago Press. 280 p. (About 157 forms salamanders, 105 forms frogs recognized)

Wright, A. H., and A. A. Wright. 1949. Handbook of frogs and toads of United States and Canada. 3d. ed. Ithaca, Comstock. 640 p.

South America

Carvalho, A. L. de. 1954. A preliminary synopsis of the genera of American Microhylid frogs. Occ. Pap. Mus. Zool. Univ. Mich. 555: 20.

Dunn, E. R. 1942. The American caecilians. Bull. Mus. comp. Zool. Harv. 91: 439-540. (About 44 species treated. A monograph of the American species)

Dunn, E. R. 1948. American frogs of the family Pipidae. Amer. Mus. Novit. 1384: 12.

Dunn, E. R. 1949. Notes on South American frogs of family Microhylidae. Amer. Mus. Novit. 1419: 21.

Taylor, E. H. 1951. Two new genera and a new family of tropical frogs. Proc. biol. Soc. Washington 64: 33-40.

ARGENTINA

Cei, J. M. 1956. Nueva lista sistematica de los Batracios de Argentina y breves notas sobre su biologia y ecologia. Invest. zool.

chil. 3: 31-68. (About 84 species and subspecies recognized)

Freiberg, M. A. 1942. Enumeracion sistematica y distribucion geografica de los batracios Argentinos. Physis, B. Aires 19: 219-240. (About 62 forms recognized)

BOLIVIA

(Apparently no complete list. About 50 species definitely known, probably many more; about 12 described since 1913)

BRAZIL

Cochran, D. M. 1955. Frogs of southeastern Brazil. Bull. U.S. nat. Mus. 206: 409.

Mirando-Ribeiro, A. 1926. Notas para servirem ao estudo dos Gymnobatrachios (Anura) Brasileiros. Arch. Mus. nac., Rio de J. 27: 227. (About 158 forms recognized)

Taylor, E. H., and Doris M. Cochran. 1953. Frogs of the family Centrolenidae from Brazil. Kans. Univ. Sci. Bull. 35: 1627-1656.

BRITISH GUIANA

Parker, H. W. 1935. The frogs, lizards and snakes of British Guiana. Proc. zool. Soc. Lond. 1935: 505-530.

BRITISH HONDURAS

Schmidt, K. P. 1941. The amphibians and reptiles of British Honduras. Zool. Ser. Field. Chicago nat. Hist. Mus. Bull. 22: 475-510. (About 17 species recognized)

CENTRAL AMERICA

Gunther, A. C. L. 1900-1902. Biologia Centrali-Americana, Reptilia and Batrachia. 197-326 p. (About 192 species recognized)

CHILE

Schmidt, K. P. 1952. A new leptodactylid frog from Chile. Fieldiana Zoology, Chicago nat. Hist. Mus. Bull. 34: 11-15. (Gives brief summary of distribution)

COLOMBIA

Dunn, E. R. 1944. Los generos de anfibios de Colombia, Part 1, Anfibios. Caldasia. 10: 497-529.

COSTA RICA

Taylor, E. H. 1952. The salamanders and caecilians of Costa Rica. Kans. Univ. Sci. Bull. 34: p. 695-771.

Taylor, E. H. 1952. The frogs and toads of Costa Rica. Kans. Univ. Sci. Bull. 35: 577-942. (About 115 forms recognized)

CUBA

Barbour, T., and C. F. Ramsden. 1919. The herpetology of Cuba. Mem. Mus. comp. Zool. Harv. 47: 73-213. (About 12 species recognized)

ECUADOR

(Apparently no complete list. About 176 species definitely known, probably many more; about 50 species described since 1913)

EL SALVADOR

Mertens, R. 1952. Die Amphibien und Reptilien von El Salvador. Abh. Senckenb. naturf. Ges. 487: 120. (About 23 species recognized)

GREATER ANTILLES

Barbour, T. 1937. Third list of Antillian reptiles and amphibians. Bull. Mus. comp. Zool. Harv. 82: 81-166. (About 96 species recognized)

GUATEMALA

Stuart, L. C. 1935-1954. Various articles in Occ. Pap. Mus. Zool. Univ. Mich. and Misc. Publ. Mus. Zool. Univ. Mich. (At least 25 species salamanders, 1 caecilian, 43 forms frogs)

HISPANIOLA

Cochran, D. H. 1941. The herpetology of Hispaniola. Bull. U.S. nat. Mus. 177: 398. (About 33 species recognized)

HONDURAS

Dunn, E. R., and J. T. Emlen, Jr. 1932. Reptiles and amphibians from Honduras. Proc. Acad. nat. Sci. Philad. 84: 21-32. (About 20 forms recognized)

JAMAICA

Lynn, W. J., and C. Grant. 1940. The herpetology of Jamaica. Bull. Inst. Jamaica, Sci. Ser. 1:148. (About 17 species recognized)

MEXICO

Kellogg, R. 1932. Mexican tailless amphibians in United States National Museum. Bull. U.S. nat. Mus. 160: 224. (About 65 species recognized)

Smith, H. M., and E. H. Taylor. 1948. An annotated checklist and key to amphibia of Mexico. Bull. U.S. nat. Mus. 194: 118. (About 161 forms recognized)

NICARAGUA

Noble, G. K. 1917. The amphibians collected by the American Museum Expedition to Nicaragua in 1916. Bull. U.S. nat. Mus. 38: 311-347. (27 species mentioned)

PANAMA

Dunn, E. R. 1931. The amphibians of Barro Colorado Island. Occ. Pap. Boston Soc. nat. Hist. 5: 403-421. (Lists 55 species native to the Island and Panama Canal Zone; mentions 23 additional species known from western Panama, 2 from eastern Panama)

PARAGUAY

(Apparently no complete list. Over 40 species mentioned from Paraguay)

PERU

(Apparently no complete list. About 80 species definitely known, probably many more; about 30 described since 1913)

PUERTO RICO AND VIRGIN ISLANDS

Schmidt, K. P. 1928. Amphibians and land reptiles of Puerto Rico, with a list of those reported from the Virgin Islands. Scientific survey of Puerto Rico and the Virgin Islands. 10: 68. (About 13 species recognized from Puerto Rico and 4 from Virgin Islands)

TRINIDAD

Parker, H. W. 1933. A list of the frogs and toads of Trinidad. Trop. Agriculture, Trin. 10: 8-12. (About 23 species recognized)

URUGUAY

(Apparently no complete list. Over 40 species mentioned from Uruguay)

VENEZUELA

(Apparently no complete list. About 50 species definitely known, probably many more; about 12 described since 1913)

Lutz, A. 1927. Notas sobre batrachios du Venezuela e da Ilha de Trinidad. Mem. Inst. Osw. Cruz. 20: 35-65.

EUROPE

Boulenger, G. A. 1897-1898. The tailless batrachians of Europe. 2 v. London, Ray Soc. 376 p.

Boulenger, G. A. 1910. Les batraciens et principalement ceux d'Europe. Paris, Octave Dion. 305 p.

Mertens, R., and L. Muller. 1940. Die Amphibien und Reptilien Europas. 2d list, Abh. Senckenb. naturf. Ges. 451: 56. (About 46 forms salamanders, 37 forms frogs recognized)

Schreiber, E. 1912. Herpetologia Europaea, 2d ed. Jena, Gustav Fischer. 960 p.

BRITISH ISLES

Smith, M. A. 1951. The British amphibians and reptiles. London, Collins. 318 p.

RUSSIA

Nikolsky, A. M. 1918. Amphibia. *In his* Faune de la Russie et des pays limitrophes. Petrograd. 309 p.

Terentiev, P. U., and S. A. Techernov. 1949. Opredelitelj presmykajus-chtschichsja i semnowodnych Moskwa (Amphibians and Reptiles of Russia) 3d ed. Moscow, State Pub. House Govt. Sci. 340 p. (About 30 species recognized)

ASIA

Boulenger, G.A. 1918. Remarks on the batrachian genera *Cornufer* Tschudi, *Platymantis* Gunther, *Simomantis* g.n., *Staurois* Cope. Ann. Mag. nat. Hist. (9) 1: 372-375. Gives a nominal list of species. *Cornufer*, 10; *Platymantis*, 8; *Staurois*, 5; *Simomantis*, 1)

Boulenger, G. A. 1920. A monograph of south Asian, Papuan, Melanesian and Australian frogs of genus *Rana*. Rec. Indian Mus. 20: 226. (About 125 species treated. Complete revision to year 1920)

Dunn, E. R. 1923. The salamanders of the family Hynobidae. Proc. Amer. Acad. Arts Sci. 58: 446-523. (About 21 species treated. Revision of the family)

Wolf, S. 1936. Revision der Untergattung *Rhacophorus*. Bull. Raffles Mus. 12: 137-217. (Asian forms reduced to 18 full species)

AFGHANISTAN

(Apparently no complete list)

Smith, M. A. 1940. Contributions to the Herpetology of Afghanistan. Ann. Mag. nat. Hist. (11) 5: 382-384. (4 species mentioned)

ARABIA

Parker, H. W. 1938. Reptiles and amphibians from southern Hejaz. Ann. Mag. nat. Hist. (11) 1: 481-492. (About 3 species recognized)

Parker, H. W. 1941. Reptiles and amphibians collected by the British Museum (Natural History) Expedition to southwest Arabia, 1937-1938. London, Brit. Mus. p. 5-6.

ASIA MINOR

Bodenheimer, F. S. 1944. Introduction into the knowledge of the Amphibia and Reptilia of Turkey. Rev. Fac. Sci. Univ. Istanbul, 9B. 1: 83. (About 20 forms recognized)

CAUCASUS

Boulenger, G. A. 1896. On some little known batrachians from the Caucasus. Proc. zool. Soc. Lond. 1896: 548-555. (About 11 species recognized)

CEYLON

De Silva, P. H. D. H. 1955. A list of Amphibia recorded from Ceylon with a report on the Amphibia in the Colombo Museum. Spolia Zeylanica 27: 243-250. (About 41 species recognized)

CHINA

Chang, M. L. Y. 1936. Contribution à l'étude morphologique, biologique et systematique des amphibiens urodèles de la Chine. Paris, Librairie Picart. 156 p.

Lui, C. 1950. Amphibians of western China. Fieldiana Zoology, Mem. Chicago nat. Hist. Mus. 2: 400.

Pope, C. H., and A. M. Boring. 1940. A survey of Chinese Amphibia. Peking nat. Hist. Bull. 15: 86. (About 87 forms recognized)

FIJI

Barbour, T. 1923. The frogs of the Fiji Islands. Proc. Acad. nat. Sci. Philad. 75: 111-115. (2 species recognized)

FLORES

Mertens, R. 1930. Die Amphibien und Reptilien der Inseln Bali, Lombok, Sumbawa und Flores. Abh. Senckenb. naturf. Ges. 42: 117-344.

INDIA
(including Ceylon and Burma)

Boulenger, G. A. 1890. The fauna of British India, including Ceylon and Burma: Reptilia and Batrachia. London, Taylor and Francis. 541 p. (About 124 species frogs, 1 salamander, 5 caecilians recognized)

INDOCHINA
(including Burma, French Indochina, Siam and Malay Peninsula)

Bourret, R. 1942. Les batraciens de l'Indochine. Mem. Serv. oceanogr. Indoch. 6: 547. (About 171 species recognized)

IRAN

Focart, L. 1950. Amphibien und Reptilien von Iran. Verh. naturf. Ges. Basel 61: 141-156.

Werner, F. 1936-1937. Reptilien und Gliedertiere aus Persien. Festschrift f. Dr. Embrik Strand, Riga. 2: 194-204. (About 9 forms recognized)

IRAQ
(and neighboring countries)

Allouse, B. E. 1955. A bibliography on the vertebrate fauna of Iraq and neighboring countries: Reptiles and amphibians. Iraq nat. Hist. Mus. Publ. 6: 21. (A complete bibliography of the literature for the above area)

JAPAN

Okada, Y. 1931. The tailless batrachians of the Japanese Empire. Tokyo, Imperial Agriculture Experiment Station. 210 p. (Includes Formosa. About 58 species recognized)

Okada, Y. 1938. A catalogue of Japanese vertebrates, Tokyo, Maruzen Co. 412 p. (79 forms recognized)

Sato, I. 1943. General account of the Japanese tailed Amphibia. Osaka, Japanese Pub. Co. 520 p.

Stejneger, L. 1907. The herpetology of Japan and adjacent territory. Bull. U.S. nat. Mus. 58: 161. (About 50 species recognized)

MALAY ARCHIPELAGO

Kampen, Van P. N. 1923. The Amphibia of the Indo-Australian Archipelago. Leiden, Brill. 304 p. (About 254 species recognized: Sumatra, 61: Borneo, 85; Java, 38; Celebes, 22; New Guinea, 85. Also contains a list for the smaller islands)

MALAY PENINSULA

Boulenger, G. A. 1912. A vertebrate fauna of the Malay Peninsula from the Isthmus of Kra to Singapore, including the adjacent island: Reptilia and Batrachia. London, Taylor and Francis. 294 p. (About 66 forms recognized)

Smith, M. A. 1930. The Reptilia and Amphibia of the Malay Peninsula. Bull. Raffles Mus. 3: 140. (About 80 species recognized)

NEW GUINEA

Loveridge, A. 1948. New Guinea reptiles and amphibians in the Museum of Comparative Zoology and United States National Museum. Bull. Mus. comp. Zool. Harv. 101: 305-430. (About 110 forms recognized)

Zweifel, R. S. 1956. Results of the Archbold Expedition 72: Microhylid frogs from New Guinea with description of new species. Amer. Mus. Novit. 1766: 49.

PALESTINE

Mendelssohn, H., and H. Steinitz. 1944. Contributions to the ecological zoogeography of amphibians of Palestine. Rev. Fac. Sci. Univ. Istanbul. 9B, 4: 289-298. (About 8 species recognized)

PACIFIC WORLD

Loveridge, A. 1945. Reptiles of the Pacific World. New York, Macmillan. 259 p. (Includes amphibians)

PHILIPPINE ISLANDS

Inger, R. F. 1954. Philippine zoological expedition 1946-1947; systematics and zoogeography of Philippine Amphibia. Fieldiana Zoology, Chicago nat. Hist. Mus. Bull. 33: 183-531. (About 56 species recognized)

RYUKYU ISLANDS

Inger, R. F. 1947. Preliminary survey of the amphibians of the Riukiu Islands. Fieldiana Zoology, Chicago nat. Hist. Mus. Bull. 34: 297-352. (About 16 species recognized)

SOLOMON ISLANDS

Brown, W. H. 1952. The amphibians of the Solomon Islands. Bull. Mus. comp. Zool. Harv. 107: 64. (About 18 forms recognized)

SYRIA

Werner, F. 1939. Die Amphibien und Reptilien von Syrien. Abh. Mus. Nat. -u. Heimatk. 7: 211-223.

AUSTRALIA

Loveridge, A. 1935. Australian Amphibia in the Museum of Comparative Zoology, Cambridge, Mass. Bull. Mus. comp. Zool. Harv. 78: 60. (About 88 forms recognized)

PARKER, H. W. 1940. The Australasian frogs of the family Leptodactylidae. Novitates Zoologicae 42: 106.

WAITE, E. R. 1929. The reptiles and amphibians of South Australia. *In* Fauna and flora of South Australia. Adelaide, Brit. Sci. Guild. 270 p.

NEW ZEALAND

TURBOTT, E. G. 1942. The distribution of genus *Leiopelma* in New Zealand. Trans. N.Z. Inst. 71: 247-253. (3 species recognized)

AFRICA

NOBLE, G. K. 1924. Contributions to the herpetology of the Belgian Congo, based on the collection of the American Museum Congo Expedition, 1909-1915. Bull. Amer. Mus. nat. Hist. 49: 147-347. (About 232 forms recognized. A checklist for the continent)

ANGOLA

MONARD, A. 1937. Contribution a la batrachologie d'Angola. Bull. Soc. neuchatel Sci. nat. 62: 5-59. (About 80 species recognized)

BELGIAN CONGO

WITTE, G. F. DE. 1934. Batraciens recoltes au Congo Belge par le Dr. H. Schouteden et par G. F. de Witte. Ann. Mus. Congo belge 3: 153-188. (About 79 species recognized)

BRITISH EAST AFRICA

LOVERIDGE, A. 1930. A list of the amphibians of the British territory in East Africa, Uganda, Kenya Colony, Tanganyika Territory and Zanzibar. Proc. zool. Soc. Lond. 1930: 7-32. (About 139 forms recognized)

LOVERIDGE, A. 1953. Amphibians from Nyasaland and Tete. Bull. Mus. comp. Zool. Harv. 110: 325-406. (About 50 forms recognized)

CAMEROONS

PARKER, H. W. 1936. The amphibians of the Mamfe Division, Cameroons. Proc. zool. Soc. Lond. 1936: 135-163.

EGYPT

FLOWER, S. 1933. Notes on the recent reptiles and amphibians of Egypt, with a list of the species recorded from that kingdom. Proc. zool. Soc. Lond. 1933: 735-851. (About 4 species of frogs recognized)

ERITREA

SCORTECCI, G. 1929. Contributo alla conoscenza degli anfibi dell'Eritria. Atti. Soc. ital. Sci. nat. 68: 175-192.

FRENCH WEST AFRICA

CHABANAUD, P. 1921. Mission Paul Chabanaud en Afrique occidentale: Liste des batrachiens et des reptiles. Bull. Mus. Hist. nat. Paris. 27: 519-526. (About 35 species mentioned, mostly from French Guinea)

ITALIAN SOMALILAND

SCORTECCI, G. A. 1933. Anfibi della Somalia Italiana. Atti. Soc. ital. Sci. nat. 72: 5-70. (About 24 species recognized from Italian Somaliland, 50 from Kenya, 40 from Abyssinia and British Somaliland)

LIBERIA

BARBOUR, T., and A. LOVERIDGE. 1930. Reptiles and amphibians from Liberia. *In* The African Republic of Liberia and the Belgian Congo, ed. by R. P. Strong. Cambridge, Harvard U. Press. p. 769-785. (About 33 species mentioned, plus an additional list)

PARKER, H. W. 1936. Amphibians from Liberia and the Gold Coast. Zool. Meded. 19: 87-102.

LIBYA

SCORTECCI, G. 1936. Gli anfibi della Tripolitania. Atti. Soc. ital. Sci. nat. 75: 129-226. (About 5 species recognized)

MADAGASCAR

ANGEL, F., and J GUIBE. 1945. Tableau des éspêces actuellement connue du genre *Pseudohemisus*, batraciens de Madagascar, et description d'une éspêce nouvelle. Bull. Soc. zool. Fr. 70: 150-154.

GUIBE, J. 1947. Description d'un batracien nouveau de Madagascar, et synonymie de plusieurs éspêces du genre *Boophis*. Bull. Mus. Hist. nat. Paris 19: 438-439.

METHUEN, P. A., and J. HEWITT. 1914. On a collection of Batrachia from Madagascar made during the year 1911. Ann. Transv. Mus. 4: 57.

MOCQUARD, M. F. 1909. Des reptiles écailleux et les batraciens de Madagascar. Arch. Mus. Hist. nat. Paris 5: 110.

NOBLE, G. K., and H. W. PARKER. 1926. A synopsis of the brevicipitid toads of Madagascar. Amer. Mus. Novit. 232: 14.

MOROCCO AND WESTERN ALGERIA

WERNER, F. 1929. Wissenschaftliche Ergebnisse einer zoologischen Forschungsreise nach Westalgerien und Marokko. S. B. Akad. Wiss. Wien 138: 34. (About 6 species recognized)

MOZAMBIQUE

MANACAS, S. 1950. Batraquios de Mocambique. Ann. Jta. Invest. colon. 5-6: 181-197.

PARKER, H. W. 1930. A collection of frogs from Portuguese East Africa. Proc. zool. Soc. p. 897-905. (About 29 species recognized)

NORTHERN RHODESIA

PITMAN, C. R. S. 1934. Report of the faunal survey of Northern Rhodesia. A checklist of the Reptilia and Amphibia occurring and believed to occur in Northern Rhodesia. Livingston. Government Printer. 292-312 p. (About 50 forms recognized)

PORTUGUESE GUINEA

MANACAS, S. 1949. Batraquios faneroglossos da Guine Portuguese. Ann. Jta. Invest. colon. 4: 143-164.

SAHARA

ANGEL, F. 1944. Contribution à l'étude de la faune herpétologique du Sahara central. Bull. Mus. Hist. nat. 16: 418-419.

SEYCHELLES

BOULENGER, G. A. 1911. List of the batrachians and reptiles obtained by Prof. Stanley Gardiner on his second expedition to the Seychelles and Aldabra. Trans. Linn. Soc. Lond. 14: 375-378. (About 5 species ceaecilians, 5 species frogs recognized)

PARKER, H. W. 1936. Revised list of reptiles (excluding chelonians) and amphibians collected in the Seychelles. Trans. Linn. Soc. Lond. 19: 444-446.

PARKER, H. W. 1941. The caecilians of the Seychelles. Ann. Mag. nat. Hist. (7) 11: 1.

SIERRA LEONE

(Apparently no complete list.)

PARKER, H.W. 1931. Some new and rare frogs from West Africa. Ann. Mag. nat. Hist. (10) 7: 492-498.

SOUTH AFRICA

FITZSIMONS, V. 1930-1950. Various papers Ann. Transv. Mus. and Ann. S. Afr. Mus.

HEWITT, J. 1909-1940. Various papers. Records Albany Mus. Grahamstown; and also Guide to the Vertebrate Fauna, Eastern Cape Province, S. Afr. (1937)

ROSE, W. 1950. The reptiles and amphibia of southern Africa. Cape Town, Maskew and Miller. 378 p. (On p. 3 Rose states that there are 1600 species of amphibians, 80 native to South Africa)

SOUTHWEST AFRICA

MERTENS, R. 1955. Die Amphibien und Reptilien Sudwestafrikas. Abh. Senckenb. naturf. Ges. 490: 124. (About 24 forms recognized)

OTHER IMPORTANT REFERENCES

BARBOUR, T. 1926. Reptiles and amphibians, their habits and adaptations. Boston, Houghton Mifflin, 125 p. (States total number of species of amphibians as: frogs, 1500; salamanders, 150; caecilians, 50)

BARBOUR, T., and G. K. NOBLE. 1920. Some amphibians from northwestern Peru, with a revision of the genera *Phyllobates* and *Telmatobius*. Bull. Mus. comp. Zool. Harv. 63: 395-427. (About 18 species listed in genus *Phyllobates*)

BOULENGER, G. A. 1913. On a collection of batrachians made by Dr. H. G. F. Spurrell, F.Z.S., in the Choco Colombia. Proc. zool. Soc. Lond. 1913: 1019-1038. (Type description of *Dendrobates paraensis* and *Dendrobates aurotaenia*)

DARLINGTON, P. J., JR. 1948. The geographical distribution of coldblooded vertebrates. Quart. Rev. Biol. 23: 1-26, 105-123.

DECKERT, K. 1938. Beiträge zur Osteologie und Systematik ranider Froschlurche. S. B. Ges naturf. Fr. Berl. 1938: 127-184.

DUNN, E. R. 1941. Notes of *Dendrobates auratus*. Copeia (2) 1941. (Gives 18 species *Dendrobates*, Brazil to Nicaragua. *Phyllobates*, 23 species, Peru to Trinidad and Costa Rica. *Hyloxalus*, 8 species, Ecuador to Guiana, north to Panama)

GRIFFITH, I. 1954. On the "otic element" in Amphibia Salientia. Proc. zool. Soc. Lond. 1954: 35-50.

HELLMICH, W. 1940. Beiträge zur Kenntnis Gattung *Hyloxalus* (Brachycephalidae Amph.). Zool. Anz. 131: 113-128.

HERRE, W. 1939. Studien an Asiatischen u Nordamerikanischen Salamandriden. Abh. Mus. Nat. -n Heimatk Magdeburg 7: 79-97. (Treats the newts)

HOFFMAN, A. C. 1932. Researches relating to the validity of the South African Polypedatidae (Rhacophoridae) as an autonomous family to Anura. S. Afr. J. Sci. 29: 562-583.

HOFFMAN, A. C. 1935. Die sistematic posiesie van *Heleophryne*. Soöl. Nav. nas. Mus. Bloemfontein 1: 1-2.

LAURENT, R. 1943. Les Hyperolius (Batraciens) du Musée du Congo. Ann. Mus. Congo belge 4: 61-140.

LAURENT, R., and J. COMBAZ. 1950. Sur l'attribution générique de certains Batraciens appartenant à la sous-famille des Hyperoliinae. Rev. Zool. Bot. afr. 43: 269-280.

LEAVITT, B. B. 1932. Comments on Polypedatidae. Copeia 1932: 178.

NICHOLLS, G. E. 1916. The structure of the vertebral column in Anura Phaneroglossa and its importance as a basis of classification. Proc. Linn. Soc. Lond. 128: 80-92.

PARKER, H. W. 1927. A revision of the frogs of genera *Pseudopaludicola*, *Physalaemus*, and *Pleurodema*. Ann. Mag. nat. Hist. (9) 20: 450-478.

PARKER, H. W. 1931. Parallel modifications in the skeleton of Amphibia Salientia. Congresso internazionale de Zoologia, Comptes Rendus, 11th, Padova, 1930 (1931). 8: 1240-1248.

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Forthcoming publications include an important work on African herpetology by A. Loveridge, on Australian Hylidae by S. J. Copland and on the Amphibia of Ceylon by P. Kirthisinghe.

BIRDS OBSERVED IN THE CENTRAL CANADIAN ARCTIC, 1953, 1955, 1956

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THE AUTHOR conducted geographical investigations on Boothia Peninsula, in southeastern Victoria Island and on southern King William Island and Adelaide Peninsula during the summers of 1953, 1955 and 1956. He was assisted in 1953 by Camille Laverdière, in 1955 by Burkhard Frebold and in 1956 by Wladek Henoch. The surveys were carried out for the Geographical Branch, Department of Mines and Technical Surveys, Ottawa, and the observations on bird life were only incidental to the main objectives of the surveys.

While no time was spent specifically observing bird life during the field seasons, birds observed were noted and attempts were made to identify them as carefully as possible. Some species, especially shore birds, were observed many times without being identified with certainty. Local inhabitants supplied some additional information. Peterson's *Field Guide to the Birds* was carried at all times in the field.

Thanks are due to Messrs. Laverdière, Frebold and Henoch who contributed to the following lists of observations.

BOOTHIA ISTHMUS, MAY 28 TO SEPTEMBER 14, 1953

Fraser and Laverdière traveled by dog sled during May and June from Spence Bay to Lord Mayor Bay, with shorter trips to Netsilik Lake and Krusenstern Lake. In early July, trips were made on foot northwest and east of Spence Bay, and in late July, August and early September, a trip was made by canoe across the isthmus to Sagvak Inlet, north to Thom Bay, west by way of the Lord Lindsay River and the chain of large lakes to Josephine Bay.

YELLOW-BILLED LOON *Gavia adamsi*. The largest of the loons, its characteristic cry was heard at numerous times on the big lakes north of Spence Bay. Never definitely distinguished from *Gavia immer*, but local reports indicate that this species is *adamsi*. Observed August 2 at the inner part of Sagvak Inlet; August 6 and 14 on Krusenstern Lake; August 13 on Lord Lindsay River.

ARCTIC LOON *Gavia arctica*. Observed many times during the summer and appeared to be the most common loon on Boothia. Noted first on June 18 at Netsilik Lake; nesting pair with one young on a small island in Angmaluktok Lake, August 3; elsewhere both on lakes and the seacoasts throughout the summer.

RED-THROATED LOON *Gavia stellata*. Apparently quite common on Boothia, this small loon was observed frequently both singly and in groups. Observed July 10 at Cape Isabella; group of six on Kangikjuke Lake August 24; pair on Josephine Bay September 3; elsewhere on lakes throughout the summer.

WHISTLING SWAN *Olor columbianus*. This bird was observed only once, a pair flying over Netsilik Lake on June 18.

CANADA GOOSE *Branta canadensis*. Observed only occasionally and then in late spring and early summer. Many were seen at Netsilik Lake in late June, and the last seen were a pair on July 13. Apparently the Canada Goose does not breed in numbers on Boothia Isthmus.

Observations: June 6, Krusenstern Lake, 4 birds on bare marsh, the only exposed land at this time; June 18-22, Netsilik Lake, large flocks; June 30, Redfish Lake, three birds in open water around lake; July 13, Lake Jekyll, male and female.

OLD SQUAW *Clangula hyemalis*. As common as the King Eider at the beginning of summer, but appeared to become scarce. Molting drakes were observed on Angmaluktok Lake on August 4.

Observations: June 18-22, Netsilik Lake, many flocks; June 30, pairs, Redfish Lake, July 2 and 3, west of Pangnikto Lake, nesting pairs; July 14, Lake Jekyll, pairs; July 29, Middle Lake, pairs; August 14, Angmaluktok Lake, molting drakes; September 2, female with brood, south of Josephine Bay.

KING EIDER *Somateria spectabilis*. Appears to be the most common duck on Boothia. The first flock was seen June 12 on Lord Mayor Bay when the sea and lakes were still frozen, landing in pools on top of the ice or in tide cracks. As soon as the lakes opened (in late June) flocking ceased. Eiders were seen singly and in pairs on the shallow ponds west of Pangnikto Lake on July 3. The latest date on which a drake in spring plumage was seen was July 14 on an inland pond and a female was seen at this time on a nest with six eggs. On August 1 a female with a brood of five was observed in Sagvak Inlet. A flock of molted males was observed in Thom Bay on August 8 and large flocks of males were seen August 19 and 20 in Spence Bay. Adults and young were flocking on the sea September 3 and 4.

Observations: June 12, Lord Mayor Bay, a flock; June 18-20, Netsilik Lake, many; June 30, Redfish Lake; July 3, near Pangnikto Lake, nesting pairs; July 13 and 14, Lake Jekyll, nesting pairs; July 14, Middle Lake, nesting female; August 1, inner Sagvak Inlet, female with five young; August 8, Thom Bay, flock of males; Lake Jekyll, August 18 and 19, female and young; August 19 and 20, Spence Bay, large flocks; August 26, Kangikjuke Lake, female and young; September 2, south of Josephine Bay, adults and young; September 3, Imilik Island, many adults and young; September 4, Spence Bay, female and young.

AMERICAN ROUGH-LEGGED HAWK *Buteo lagopus*. This is the most common bird of prey on Boothia Isthmus and, like the Peregrine Falcon, is encountered in areas of rocky cliffs, both along the sea coasts, and inland. We observed no hawks on the lowland plain. They were invariably observed circling high above their nests, with harsh protesting cries which began as soon as we were sighted and continued until we were out of sight. They were much more timid than the falcons when we investigated their nests.

Observations: June 20, Netsilik Lake, male and female; July 9, Cape Isabella, single bird; July 10, Cape Isabella, female and nest with four eggs; Middle Lake, male and female; July 30, near Middle Lake, male (black phase) and female with three young in nest, one egg unhatched; August 3, Netsiksiuvik Inlet, solitary; August 6, Krusenstern Lake, solitary; August 7, Kogaluktok Falls, solitary; August 12 and 13, Lord Lindsay Lake, solitary; August 26, Kangikjuke Lake, male and female; August 31, Garry River, male and female; September 1, Josephine Bay, three birds over a nest; September 2, Josephine Bay, solitary.

GYRFALCON *Falco rusticolus*. This bird, a solitary flying over the shores of a large lake in lowland plain terrain, was observed only once during the field season. It was the white phase of the Gyrfalcon, being almost entirely in white except for occasional gray markings.

Observations: August 22, Lake Jekyll (observed again August 24, only 5 miles distant, but presumed to be the same bird).

PEREGRINE FALCON *Falco peregrinus*. Encountered near high rocky cliffs and never on the plain. Next to the Rough-legged Hawk, this is the most common bird of prey on Boothia.

Observations: July 4, Long Lake (near Spence Bay), female; July 12, west of Cape Isabella, parents and nest with three eggs; July 31, inner Sagvak Inlet, solitary bird; August 3, Netsiksiuvik Inlet, solitary bird; August 6, Krusenstern Lake, solitary bird; August 27, Kangikjuke Lake, parents and flying young; August 31, Garry River, solitary bird; September 7, near settlement at Spence Bay, young female.

ROCK PTARMIGAN *Lagopus mutus*. Ptarmigan appeared to be scarce on Boothia Isthmus. Only four observations of this bird were made during the late spring and summer.

Observations: June 3, Netsiksiuvik Inlet, white plumage; June 20 and 22, Netsilik Lake, white plumage; July 14, Middle Lake, four birds, mottled.

SEMIPALMATED PLOVER *Charadrius semipalmatus.* Shore birds were seen almost every day during the summer, but not many were identified with certainty. This plover was identified five times, but probably was seen much more often. On August 2 and 6, chicks were seen with the adults.

Observations: June 20, Netsilik Lake; July 3, west of Pangnikto Lake; July 10, Cape Isabella; August 2, near Sagvak Inlet; August 6, Krusenstern Lake.

BLACK-BELLIED PLOVER *Squatarola squatarola.* Observed singly only a few times, apparently not common on Boothia Peninsula.

Observations: June 21, Netsilik Lake; July 13 and 14, Lake Jekyll; August 5, Krusenstern Lake.

WHITE-RUMPED SANDPIPER *Erolia fusciollis.* These shore birds were observed in company with Sanderlings and Baird's Sandpipers on the shore of Lake Jekyll, as well as in mid-June at Netsilik Lake.

Observations: June 21, Netsilik Lake; August 22, Lake Jekyll.

BAIRD'S SANDPIPER *Erolia bairdi.* Positively identified only in one location, where camp was made for several days on the shore of Lake Jekyll.

Observations: August 22-25, Lake Jekyll.

SANDERLING *Crocethia alba.* As with the other shore birds, the Sanderling was probably seen on numerous occasions but was identified only occasionally. A nesting female with four eggs was seen on July 15. By the end of the month, chicks were observed with the adults. On August 22, Sanderlings were observed with many Baird's Sandpipers.

Observations: July 10 and 11, Cape Isabella; July 15, Middle Lake; July 30 and 31, inner Sagvak Inlet, parents and young; August 22, Lake Jekyll.

POMARINE JAEGER *Stercorarius pomarinus.* Apparently as common on Boothia Isthmus as the Long-tailed Jaeger, but no nests of this species were observed. No Parasitic Jaegers were identified.

Observations: June 7, Krusenstern Lake; June 18, Netsilik Lake; June 20, Netsilik Lake; June 30, Redfish Lake; July 2 and 3, west of Pangnikto Lake; July 14, Lake Jekyll; July 29, east of Middle Lake; August 15 and 16, Krusenstern Lake; August 18, Lake Jekyll.

LONG-TAILED JAEGER *Stercorarius longicaudus.* First observed on Boothia in early July when a nest with eggs was observed. Young were flying with their parents on August 19. The last pair observed, August 26, were possibly of the dark phase.

Observations: July 10, Cape Isabella; July 14, Lake Jekyll; August 15, Krusenstern Lake; August 19, Lake Jekyll; August 21 and 22, Lake Jekyll; August 26, Kangikjuke Lake.

GLAUCOUS GULL *Larus hyperboreus.* Observed in pairs or in small colonies several times during the field season. Two young observed September 2, still could not fly.

Observations: June 18, Netsilik Lake, several adults; July 13, Lake Jekyll, pair of adults; August 5, Krusenstern Lake, several adults; August 6, Krusenstern Lake, a small colony on rocky cliffs, six to eight couples with young standing in the nests; August 7, Krusenstern Lake, several adults; August 10, Thom Bay, larger colony; August 13, parents and two young still in down stage; August 26, Kangikjuke Lake, adults; August 31, Garry River, adults; September 2, Josephine Bay, parents and two young; September 3, near Imilik Island, several adults and juveniles; September 4, Spence Bay, on small islands, eight or nine adults.

HERRING GULL *Larus argentatus.* More common than the Glaucous Gull; observed almost daily during the season. Appeared quickly in early June in Lord Mayor Bay whenever a seal was killed. More frequently observed on the east coast of Boothia than on the west, and more common along the sea coasts than inland. Seen all summer around the fish racks by the R.C.M.P. detachment.

Observations: June 4, Spence Bay; June 5, inner Sagvak Inlet; June 6-8, Lord Mayor Bay; June 17-22, Lord Mayor Bay; June 18-22, Netsilik Lake; July 20, Spence Bay; July 29, Middle Lake; July 31, inner Sagvak Inlet; August 1, Sagvak Inlet, a large colony on cliffs.

IVORY GULL *Pagophila alba.* Reported by R.C.M.P. and natives as occasional near Cape Isabella. None was observed during the 1953 field season.

ARCTIC TERN *Sterna paradisaea.* Observed on Boothia only on the inland low plains. First seen in early June before any open water either on sea or lakes. No nest or young was observed.

Observations: June 7, Krusenstern Lake; June 8, Lake Jekyll; June 30, Redfish Lake; August 5, Krusenstern Lake; August 18, Lake Jekyll; August 21, Lake Jekyll; August 26, Kangikjuke Lake; August 28, Kangikjuke Lake.

SNOWY OWL *Nyctea scandiaca.* Observed only seven times during the field seasons, always alone except once. A female and one young were seen August 15; the chick had almost lost his down, but still could not fly, though it was already a large bird. The plumage of the young was mottled gray.

Observations: June 7, Krusenstern Lake; June 21, Netsilik Lake; July 10, Cape Isabella; July 29, Middle Lake; August 15, Krusenstern Lake; August 19, near the post, Spence Bay; September 4, near the post, Spence Bay, a female collected by an Eskimo.

HORNED LARK *Eremophila alpestris.* Not common on Boothia, individuals were identified only twice, both times in early summer.

Observations: June 24, Middle Lake; July 2 and 3, west of Pangnikto Lake.

NORTHERN RAVEN *Corvus corax.* Seen on only six occasions throughout the season, always singly.

Observations: June 11, Thom Bay; June 12, Lord Mayor Bay; July 9, near Cape Isabella (dead); July 29, Middle Lake; August 1, inner Sagvak Inlet; August 8, Thom Bay.

AMERICAN PIPIT *Anthus spinoletta.* Individuals were observed on only three occasions always in rough rocky terrain.

Observations: July 4, Middle Lake; August 3, Angmaluktok Lake; August 7, Krusenstern Lake near Kogaluktok Falls.

LAPLAND LONGSPUR *Calcarius lapponicus.* As common as the Snow Bunting on Boothia Peninsula. They were observed nearly every day from June 18, the male and female often seen together in flight. By July 24, young birds were flying well. Longspurs began flocking about the middle of August. As with the bunting, observations were too common to record.

SNOW BUNTING *Plectrophenax nivalis.* Recorded regularly through the season on Boothia Peninsula, also at Churchill, Manitoba, Baker Lake, and at Gjoa Haven, King William Island. No nests were observed. These birds were found near settlements and in isolated areas, on the sea coast and on lakes, in rugged rocky country and on lowland plains. Observations were almost daily throughout the season.

SOUTHEASTERN VICTORIA ISLAND, MAY 27 TO AUGUST 28, 1955

Fraser and Frebold traveled by dog sled from Cambridge Bay to Padliak Inlet, the southern arm of Albert Edward Bay, and returned by way of Anderson Bay June 5. A second sled trip was made in June westward to Wellington Bay and back by way of Ferguson Lake. Trips on foot were made in early July to Ferguson Lake. During August and early September, three journeys were made by boat along the coast from Cambridge Bay to Starvation Cove, from Cambridge Bay east to De Haven Point and from Cambridge Bay to Wellington Bay and the western half of Ferguson Lake.

YELLOW-BILLED LOON *Gavia adamsi.* Not common in the area; identified only once, at Long Point on June 11. The Red-throated Loon is reported by local inhabitants to occur in the area, but is apparently not as common as either of the other two species.

ARCTIC LOON *Gavia pacifica.* Most common of the loons in this area. Noted on numerous occasions on Ferguson Lake and other smaller lakes. First noted June 16; again June 18 on Ferguson Lake; July 2 on Greiner Lake; August 5 at Anderson Bay.

CANADA GOOSE *Branta canadensis.* One of the earliest arrivals. Two unidentified geese were seen flying over Cambridge Bay on May 25. A flock of 70 Canada Geese was seen on a patch of marshy ground ten miles east of Mount Pelly on May 29 and a flock of 10 near Padliak Inlet (the south arm of Albert Edward Bay) on June 3. Canada Geese were noted at various times throughout the summer; west arm of Cambridge Bay on June 10; near Anderson Bay June 4; near Ferguson Lake June 17; near the settlement at Cambridge Bay June 30; near Greiner Lake July 2. Local report states that they breed throughout the area.

WHITE-FRONTED GOOSE *Anser albifrons.* Several identifications were made in the spring of small groups of these geese. Over ice-covered lakes near Mount Pelly, 2 and 3 were sighted May 28. A pair was seen June 3 near Anderson Bay. Near Greiner Lake on July 2 another pair was seen. Native reports state that they breed extensively throughout the area.

OLD SQUAW *Clangula hyemalis.* Occur throughout the area and are more numerous than any other duck. Noted first on June 3, a small flock at Anderson Bay; a small flock at Long Point on June 11; pairs along the south shore of Ferguson Lake June 16; pairs on small lakes near Mount Pelly June 17; pairs on Greiner Lake July 2; large flocks on the sea off De Haven Point August 10. Noted at numerous times throughout the summer elsewhere.

PACIFIC EIDER *Somateria mollissima v-nigra.* Less common than the King Eider in southeastern Victoria Island. Small groups noted between Long Point and Cape Enterprise June

12 landing in leads; at Anderson Bay in pairs on August 5. They are reported to occur more numerously on Kent Peninsula.

KING EIDER *Somateria spectabilis*. This duck occurs throughout the entire southeastern part of Victoria Island. Several were noted on June 17 on small lakes near Mount Pelly; June 17 on Greiner Lake; June 30 on small ponds near Cambridge Bay; large flocks at De Haven Point on August 10.

AMERICAN ROUGH-LEGGED HAWK *Buteo lagopus*. This bird, preferring rocky cliffs, is scarce throughout the area as such sites are seldom found. However, in the absence of cliff eyries, this hawk was found to have selected a nest site atop a five-foot high granite erratic lying on an otherwise fairly level plain. Four young, nearly full-grown, were found here on August 26. Other sightings of this hawk occurred ten miles east of Mount Pelly on May 29; near Anderson Bay (where high cliffs occur) June 3 and August 5; August 17 near Ferguson Lake (the one referred to above).

PEREGRINE FALCON *Falco peregrinus*. As in the case of the hawk, the scarcity of cliff eyries results in this bird being scarce in southeastern Victoria Island. Only one sighting was made, on August 28, two pairs were nesting on rocky cliffs near the west end of Ferguson Lake.

The Rough-legged Hawk and the Peregrine Falcon are reported by the natives to occur in numbers on Kent Peninsula where rugged terrain offers them good nesting sites. The Merlin was pointed out in Peterson's handbook to an Eskimo and he stated that this bird also occurred on Kent Peninsula, as did the Golden Eagle.

PTARMIGAN *Lagopus sp*. Very common in the area. Noted throughout the summer and spring and occurring in flocks of 10 to 20 in the spring. They were most common near Padliak Inlet. Observed near Greiner Lake May 26; east of Mount Pelly May 28 and 29; at Padliak Inlet May 30, 31 and June 2 and 3; near Anderson Bay June 4; at Long Point June 11; numerous observations throughout the summer.

SANDHILL CRANE *Grus canadensis*. Not observed in the area, but reported to have been seen at Cambridge Bay and to breed on Kent Peninsula.

SEMIPALMATED PLOVER *Charadrius semipalmatus*. A pair seen near Mount Pelly June 18. A small unidentified plover noted at Long Point June 11.

GOLDEN PLOVER *Pluvialis dominica*. Common throughout the area. Seen near Mount Pelly May 29 and June 18; near Anderson Bay June 4; along west arm of Cambridge Bay June 10; near Greiner Lake July 2.

BLACK-BELLIED PLOVER *Squatarola squatarola*. Noted on only one occasion, June 11, at Long Point.

SANDERLING *Crocethia alba*. Identified on one occasion, nesting near Ferguson Lake July 7-13, hatching July 13. Undoubtedly common throughout the area but not distinguished from other sandpipers.

RED PHALAROPE *Phalaropus fulicarius*. Noted on small ponds near the settlement at Cambridge Bay June 30.

POMARINE JAEGER *Stercorarius pomarinus*. Appears to be nearly as common as the Long-tailed Jaeger in this area. Noted at Long Point June 11; near Mount Pelly June 17 and 18; noted while traveling in boat at other times during the summer.

LONG-TAILED JAEGER *Stercorarius longicaudus*. Noted on several occasions during the spring and numerous times during the summer. Observed at Cape Enterprise (the east cape of Wellington Bay) June 13; near Mount Pelly June 17; near Greiner Lake July 2; near Ferguson Lake July 5; near the settlement at Cambridge Bay June 30, nesting pair.

HERRING GULL *Larus argentatus*. Common throughout the area. Not distinguished from the Glaucous Gull in our observations. No large colonies were noted.

SABINE'S GULL *Xema sabini*. Noted on several occasions. Observed June 16 on Ferguson Lake; June 17 near Mount Pelly.

ARCTIC TERN *Sterna paradisaea*. Common along the sea coast. Noted first between Long Point and Cape Enterprise in numbers June 12; along south shore of Ferguson Lake June 16; near Greiner Lake July 2; at Flagstaff Point July 26; elsewhere during boat travel in August.

SNOWY OWL *Nyctea scandiaca*. Not as common as might be expected in the area, possibly because of a low in the lemming cycle in 1955. Noted May 28 near Mount Pelly; June 10 along the west arm of Cambridge Bay; June 17 a pair near the south shore of Ferguson Lake; August 10 near De Haven Point. Owl perches noted commonly on the lowland north of Cambridge Bay.

AMERICAN PIPIT *Anthus spinoletta*. Seen on one occasion only, in a large gully just west of Long Point on July 30.

LAPLAND LONGSPUR *Calcarius lapponicus*. Common throughout the area. Noted near the settlement at Cambridge Bay May 25; near

Mount Pelly May 29; at Anderson Bay June 3; at Long Point June 11; near Mount Pelly June 18; elsewhere throughout the summer.

SNOW BUNTING *Plectrophenax nivalis*. More common than the Longspur. Noted first at Cambridge Bay May 21 around the settlement; seen almost every day throughout the field season.

In conversation a native pointed out the Mallard in Peterson's handbook as occurring occasionally near Albert Edward Bay. He had lived for several years in the Mackenzie delta and was familiar with the Mallard. Brant are said to breed at the northwest end of Albert Edward Bay. White residents at the settlement at Cambridge Bay stated that they saw two robins early in May.

SOUTHERN KING WILLIAM ISLAND AND NORTHWESTERN ADELAIDE PENINSULA, JUNE 24 TO SEPTEMBER 14, 1956

Fraser and Henoch investigated Gibson Peninsula east of Gjoa Haven on King William Island during June and early July. During August and early September a boat trip was made along the southern coast of King William Island, then to northern Adelaide Peninsula and the northwest part of Sherman Inlet.

YELLOW-BILLED LOON *Gavia adamsi*. On several occasions a large loon was seen flying and on others the typical wavering cry of the Common Loon was heard. Distinguished by the natives and reported to have a yellow bill rather than black. No certain identification. Apparently much more scarce than the Pacific Loon.

ARCTIC LOON *Gavia arctica*. The most common loon in the area, far outnumbering the smaller Red-throated Loon and the Common or Yellow-billed Loon. Noted throughout the season in pairs or groups, both on small and large lakes and on the sea. The varied calls of this loon included a mournful, low, rising call, often repeated, almost a moaning, breaking occasionally into a sharp cry; a short, sharp yelp, resembling that of a kicked dog, on diving; a croaking or chuckling, in groups, punctuated by a sharp yelp; a gentle moaning with no rising toward the end; and a loud, flat quacking, in flight, quickening in repetition, often repeated.

RED-THROATED LOON *Gavia stellata*. This little loon was noted on several occasions. Even more vocal than the Arctic Loon and more wary.

WHISTLING SWAN *Olor columbianus*. Common throughout southern King William Island and the adjacent mainland. Noted nesting on the marshy shores of small lakes within a quarter-mile of settlement on King William Island. Seen flying in groups of four to six in late June, in pairs on salt water and land during the molting season in early August. Nest with one egg examined June 26. Native report that no more than two eggs are laid per season; however, local report of four eggs the previous summer in the same nest as that examined.

CANADA GOOSE *Branta canadensis*. Common throughout the area, both on the Island and the mainland. Small groups noted on marshes at M'Clintock Bay in late June; occasional pairs throughout the summer; one large flock running on shores of inlet in northwestern Sherman Basin August 26; small flock again at M'Clintock Bay September 8.

No other species of goose was identified during the summer, although the Snow Goose *Chen hyperborea* and Common Brant *Branta bernicla* are common migrants. Local report states that Snow Geese pass Gjoa Haven to nesting grounds on northern King William Island and Somerset Island.

CANVASBACK *Nyroca valisineria*. Only by report, from George Porter, Gjoa Haven, of a pair of ducks which he believed were Canvasbacks, on the lakes near Gjoa Haven.

OLD SQUAW *Clangula hyemalis*. The Old Squaw and the King Eider are the two most common species of duck in the area. Old Squaw ducks were noted almost daily by sight or call throughout the summer.

PACIFIC EIDER *Somateria mollissima v-nigra*. Scattered throughout the area, but localized in quantity around Simpson Strait. Apparently not quite as numerous as the King Eider, and scarce towards Gjoa Haven and eastward.

KING EIDER *Somateria spectabilis*. Common throughout; nesting on comparatively well-drained grassy uplands; clutches of three to five eggs noted, often close to settlements; nesting females occasionally not frightened easily and in one case allowed handling; flocking in groups of up to 50 near Simpson Strait in early September; in Sherman Inlet in late August.

AMERICAN ROUGH-LEGGED HAWK *Buteo lagopus*. Two pairs noted in northwestern Sherman Basin, nesting on rocky cliffs above lakes. Not seen or reported on King William Island where cliffs are scarce. The one nest examined had two nearly full-grown young on August 27.

PEREGRINE FALCON *Falco peregrinus.* Three nests observed in Falcon Inlet in northwestern Sherman Basin, August 26-28, on rocky cliffs above water. Young flying in all cases except for one young still with some down. The eyries contained evidence of small birds only, with no lemming remains. Extremely noisy and hostile, in contrast with the Rough-legged Hawks, which remained circling high, mewing.

PTARMIGAN, *Lagopus* sp. Common throughout the area, the particular species was not identified. Appeared to be more common on the mainland than on King William Island. According to local report, ptarmigan were much more common around Gjoa Haven ten to twenty years ago, occurring as large flocks. In the last two years, quite scarce.

SANDHILL CRANE *Grus canadensis.* Observed as pairs in northwestern Sherman Inlet, August 26-28. As many as six flying or feeding together at a time. Reported from King William Island along the coast.

SEMIPALMATED PLOVER *Charadrius semipalmatus.* A pair observed in late June on lowland marshes near M'Clintock Bay.

GOLDEN PLOVER *Pluvialis dominica.* Pairs noted on King William Island at various places along the south coast.

BLACK-BELLIED PLOVER *Squatarola squatarola.* Pairs noted on King William Island at various places along the south coast.

TURNSTONE *Arenaria interpres.* Noted on the marshes along south coast of King William Island. Common on the island; less common on the adjacent mainland.

PECTORAL SANDPIPER *Erolia melanotos.* Noted in June on marshes near M'Clintock Bay. May have been seen elsewhere, but no certain identification; this applies also to Baird's Sandpiper and the White-rumped Sandpiper.

SANDERLING *Crocethia alba.* Identified in early September in Sherman Inlet in small groups; nesting on King William Island near coast and small lakes.

RED PHALAROPE *Phalaropus fulicarius.* Common along the south coast of King William Island and on the mainland wherever there are wet marshes.

POMARINE JAEGER *Stercorarius pomarinus.* Next to the Long-tailed Jaeger, the most common in the area. Observed half a dozen times during the summer on King William Island and the mainland.

LONG-TAILED JAEGER *Stercorarius longicaudus.* By far the most common of the jaegers, being seen on an average of once every two days. Nests observed on several occasions, having one or two eggs. Common both on King William Island and the mainland.

PARASITIC JAEGER *Stercorarius parasiticus.* Observed on one ocasion only, near Sherman Inlet, on August 29.

HERRING GULL *Larus argentatus.* Common throughout the area. Not distinguished from the Glaucous Gull in our observations. Noted colonies nesting on islands in inlets on Adelaide Peninsula.

SABINE'S GULL *Xema sabina.* Remarkably common in the area. Noted nesting at M'Clintock Bay and Schwatka Bay in late June and early July. Noted elsewhere throughout the summer and appears to be locally as common as the Herring or Glaucous Gulls. As common on the mainland as on King William Island.

ARCTIC TERN *Sterna paradisaea.* Common locally, especially in the vicinity of small islets. Noted in Douglas Bay (downy chick) August 6; Peffer River, on Adelaide Peninsula and Sherman Inlet.

SNOWY OWL *Nyctea scandiaca.* Observed on the mainland only. This may be related to the present low in the lemming cycle and the presence of ground squirrels on the mainland. Observed commonly on Adelaide Peninsula and in Sherman Inlet.

RAVEN *Corvus corax.* Noted on two occasions only, in Sherman Basin August 27, and along Sherman Inlet, September 2. Reported from Gjoa Haven, arriving in the fall.

AMERICAN PIPIT *Anthus spinoletta.* Observed on one occasion only, August 27, a pair, on the west coast of Sherman Basin. This area was the only rough, rocky terrain visited during the summer.

SAVANNAH SPARROW *Passerculus sandwichensis.* Observed at Gjoa Haven, July 5. Reported to arrive every year and to be the last bird to leave in the fall. A single pair noted.

LAPLAND LONGSPUR *Calcarius lapponicus.* Common throughout the area. Nests noted with clutches of four and five eggs in late June and early July, under rocks. Seen daily.

SNOW BUNTING *Plectrophenax nivalis.* Common throughout the area, although not nearly so common as the longspur. Noted on numerous occasions; most numerous at Gjoa Haven.

PLACE NAMES

In this report a number of place names are used which are the result of these expeditions, and while they have been officially adopted by the Canadian Board on Geographic Names, they have not yet appeared on subsequent editions of the National Topographic Series maps.

A list of these names and their co-ordinates follows:

Adopted May 6, 1954

Netsilik Lake	69°19′	93°00′
Lord Lindsay Lake	70°06′30″	92°50′
Kangikjuke Lake	69°51′	93°51′
Kogaluktok Falls	70°03′	92°25′
Redfish Lake	69°31′30″	93°45′
Angmaluktok Lake	69°44′30″	93°00′
Netsiksiuvik Inlet	69°42′30″	92°48″
Pangnikto Lake	69°32″	93°00′
Imilik Island	69°25′30″	94°00′
Krusenstern Lake	69°52′	93°00′
Sagvak Inlet	69°41′	92°39′

Adopted March 7, 1957

Ferguson Lake	69°27′	105°30′
Cape Enterprise	69°10′30″	106°22′
Flagstaff Point	69°03′	105°06′

Adopted April 4, 1957

Falcon Inlet	67°45′30″	98°04′
Sherman Basin	67°50′	97°30′
Sherman Inlet	68°00′	98°21′
M'Clintock Bay	68°39′	97°43′
Gibson Peninsula	68°49′	95°24′
Padliak Inlet	69°10′	105°42′

NOTES

Distribution and Occurrence of *Gnorimella maculosa* (Knoch)[1]

Gnorimella maculosa (Knoch), a striking scarab, has been considered a rare beetle throughout its range in eastern North America. This species is black with long yellow pubescence, and the yellow spots on the head and thorax vary in specimens. The brown elytra have variable black areas and contrast with the almost entirely yellow pygidium. Ritcher (1945, p. 17) states that "*Gnorimella maculosa* is a rather uncommon, medium-sized species ranging from Connecticut to Florida and westward to Indiana." Recent collecting by the author has revealed that this is probably another example of a supposedly rare species that could very likely be obtained in some numbers in a small local area where it is known to occur. A few authors mentioned in the selected bibliography have recorded this beetle as occurring from Chambly County and Montreal Island, Quebec, south through the New England States to Florida and westward to Indiana. The Canadian National Collection contains specimens from three localities not given in the literature: Ottawa and Walsingham, Ontario; and Wakefield, Quebec. The Wakefield record extends the known range slightly in the north of Canada.

To support my theory that this beetle is not rare, I submit the following data. When one specimen was collected at Wakefield on June 26, 1956, three others were observed to fly towards a large group of *Cornus rugosa* Lam. in full flower. They were soon observed to have the habit of flying rapidly around the dogwood flowers, buzzing loudly like bees. They would rest momentarily on the flowers, fly away, and then return. This action was repeated a few times while the sun was out. The one specimen taken was collected when it was cloudy; the insect then clung quietly to the dogwood flowers.

Ritcher (p. 3) also wrote concerning the larvae: "The food of cetoniid larvae consists of organic matter in the soil, decaying wood or trash, and other debris accumulated in the hollows of trees and elsewhere." The Wakefield specimens were observed in what may be an ideal location for the development of *Gnorimella* larvae. A steep slope covered with large, jagged rocks supports abundant flowering plant life, decaying trees, and much decaying forest debris, undisturbed most of the time owing to the ruggedness of the terrain.

According to a few records in the literature, *maculosa* has been collected from the flowers of *Liriodendron*, *Rubus*, *Crataegus*, *Malus*, and *Rhus* spp., and from the leaves of *Viburnum* sp. These facts suggest that, if four beetles were present in such a small area during one afternoon, a thorough search in similar habitats might show that this species is not so rare as generally reported.

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STANTON D. HICKS

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Ottawa, Ontario
5 June 1957

A Tame Ruffed Grouse

ON THE morning of June 1, 1957, I was walking in a patch of woodland near the Ottawa River when I observed a male Ruffed Grouse *Bonasa umbellus* on the ground about twenty feet away. I stopped to look at him but instead of moving off, the bird came toward me, uttering a soft cluck and a rather high-pitched cooing note. I walked slowly away and he accompanied me at a distance of six to ten feet. After going about fifty feet I sat down on the ground and he gradually approached closer, walking back and forth in front of me and occasionally circling behind me until he was within arm's length. He was at this time making the cooing note almost exclusively. I held out my hand toward him and he approached it slowly, walking back and forth, and then hopped up and struck my hand with his wing. He repeated this a number of times, once hopping right onto my hand and buffeting my arm with both wings. Occasionally he pecked at my hand but was generally inaccurate and only once actually pecked my hand. He did not spread his tail or erect his ruff. He continued the performance for about half an hour when I got up and slowly walked away. He followed close behind, occasionally running at my heels, and if I stopped and held out my hand he would come up and strike it again with his wing. He escorted me for another ten or fifteen yards and then turned back.

On June 6 I returned to the same area in company with Mrs. A. E. H. Petrie and we found what was obviously the same bird for he went through almost exactly the same performance. If we stood together he would not approach within arm's reach, but if one stood some distance away he would approach and strike the arm of the other when it was held out toward him. The hen grouse was not observed on either occasion.

J. WALTON GROVES

Science Service Building
Ottawa, Ontario
8 June 1957

REVIEWS

Audubon Western Bird Guide

By RICHARD H. POUGH. Color illus. by Don Eckelberry; line drawings by Terry M. Shortt. Garden City, Doubleday, 1957. 316 p. $5.75.

In format, this volume is similar to the excellent *Audubon Bird Guide: Small Land Birds* and *Audubon Water Bird Guide*, by the same author and publisher, which deal with the birds of eastern and central North America (reviewed, Can. Field. Nat., 69: 28, 1955). The scope of the present volume is western North America, in Canada extending from the eastern slope of the Rockies to the Pacific Ocean and northward to the high Arctic.

This volume is designed to be used with the Audubon eastern guides. It treats fully and well those western species whose range does not extend into the central parts of the continent as well as the species known to have strayed to western North America, or to have been successfully introduced from other parts of the world. However, for those many species found in the West but which occur also in central and eastern North America, the reader is referred to the Audubon eastern guides for information on identification, habits, voice, nesting and for colored plates.

The 204 species that are treated fully in this volume are handled in the same admirable manner that characterized the eastern guides, the text containing data on full identification characters, habits (including excellent notes on habitat preferences), voice, nesting, and range. The information is up-to-date, accurate, concise, and well chosen. The 32 plates have 340 color illustrations of 219 species, the work of Don Eckelberry, and 138 line drawings by Terry M. Shortt covering 112 birds are distributed through the text. The work of both these outstanding artists is excellent.

The range summaries are, for the most part, extremely well done. The few points this reviewer might question include the breeding of the Field Sparrow in Nova Scotia; the nesting of the Northern Shrike in New Brunswick, southern Quebec and central Saskatchewan; and the breeding of the Audubon Warbler and Dusky Flycatcher in any part of Saskatchewan other than the extreme southwestern corner.

This volume is notable for its coverage of certain species which, because they are accidental or of restricted range in the Northwest, do not often get adequate treatment in the average North American book. For instance, the Skylark which is successfully introduced in the Saanich Peninsula of Vancouver Island and the Crested Mynah which is established in the Vancouver area, are fully treated and illustrated, as also are strays from Asia. Such birds heretofore have been just names in the A.O.U. check-list to the many who cannot afford an expensive library.

Although this volume, for the reasons mentioned, is somewhat limited, it combines with the two eastern Audubon guides to form one of the most useful works in North American ornithological literature.

W. EARL GODFREY

Handbook of Snakes of the United States and Canada

By ALBERT HAZEN WRIGHT and ANNA ALLEN WRIGHT. Ithaca, Comstock, 1957. Two volumes, 1,105 p. $16.00 set.

With the release of this two-volume work on the snakes of United States and Canada, the Comstock Publishing Company has completed its series of herpetological handbooks. The series covers salamanders, frogs and toads, lizards, turtles, and now snakes, and is indispensable to those interested in North American amphibians and reptiles.

To those who are acquainted with the Wright and Wright *Handbook of Frogs and Toads*, the organization of the *Handbook of Snakes* will be familiar. Each of the 308 specimens is treated under the headings: range, with state list and elevation; size; longevity; distinctive characteristics; color, habitat and habits; period of activity; breeding, including mating, eggs and young; ecdysis; food; venom; enemies; field notes and authorities. In addition, there are black-and-white photographs of every species showing separately the overall dorsal and ventral appearance, as well as close-up shots of portions of the head, body and tail. It is a bit overwhelming when one contemplates the years of effort devoted to photographing and compiling accounts for all these species. So many authors are quoted or cited, that they are being arranged in a bibliography of North American ophiology which will appear as Volume 3 in this set. This key to the snake literature of North America is as important and monumental a contribution as are the keys and descriptions of the snakes themselves in Volumes 1 and 2.

The material in these volumes is too exhaustive to be reviewed in any detail, but certain features of the handbook should be mentioned. The illustrated introduction covers 31 pages and 15 topics, many of them being invaluable syntheses of subjects such as breeding, ecdysis, eggs, adult size and food. Every young naturalist would profit and be encouraged by reading this section for the Wrights point out that the chief emphasis in North American ophiology has been on describing external characters. Our knowledge of life histories, food, movements, habits, general ecology, associations and color phases is fragmentary if not infinitesimal. Natural history societies should take note, for what we need are devoted 'reptile watchers' comparable to those groups of binocular-laden enthusiasts who have contributed so much to our knowledge of the avifauna.

A further noteworthy feature of the introduction is the inclusion of maps depicting ranges of important environmental plants, a structural map of the United States and Mexico, a forest distribution map, a map of major physical divisions of the United States, and one of plant growth regions. However, except for the forest map, Canada is not included.

The second volume concludes with an illustrated glossary, four pages of general references and an index.

Unfortunately for Canadian readers, the distributional information is both inaccurate and incomplete. Of the 34 species of snakes found in Canada, this reviewer noted that the distribution maps of nine are incorrect, three maps are cut off short near the Canadian border, and there are four instances of incorrect distributional data in the text. E. B. S. Logier's *Check-list of Amphibians and Reptiles of Canada and Alaska* will be a necessary supplement to the *Handbook* for those interested in the distribution of snakes within Canada. The Wrights cite Logier's work in their list of general references, but apparently have not incorporated his data in their book. A further criticism is the exclusive use of photographs to depict the characters of each species. Many of the photographs are disappointing because they are too small, too dark, out of focus, or have details obscured by strong highlight or strong shadow. Details of color pattern and scale pattern are best illustrated through drawings, a fact that is exemplified by the popular works of R. C. Stebbins on the western amphibians and reptiles.

However, no amount of minor criticism should distract one from appreciating the immensity of the contribution which these three volumes will make towards furthering the study of snakes in North America.

SHERMAN BLEAKNEY

Bird Navigation

By G. V. T. MATTHEWS. Cambridge, University Press and Toronto, Macmillan Co. of Canada. 1955. 141 p. $2.50. (Cambridge Monographs in Experimental Biology, No. 3)

The problems of bird navigation have aroused man's curiosity for centuries because of their involvement with bird migration and with the ancient sport of pigeon racing. Until recently study of the problems seldom went beyond ungoverned speculation; but the last twenty years have seen them attacked by a wide variety of workers in various branches of science. To the speculation, some of it governed by practical limitations and accordingly beneficial, there have been added a number of theoretical proposals and almost countless experiments. The experiments have ranged from the haphazard and slipshod to models of the scientific method. Few will question the statement that Dr. Matthews' series of scrupulously controlled studies have made him the leader in this field. The literature has become so vast and is scattered through so wide a range of journals that to keep abreast of it is no longer possible for workers in other fields. This monograph is thus doubly welcome: it summarizes all previous studies and, in a final chapter, discusses what at present seems to be the only tenable hypothesis, navigation by detection of changes in the inclination of the sun's arc.

Although, at first glance, such a mechanism may seem hard to accept, there is a large body of experimental evidence to support it. Moreover such a system must be dependent on a well-developed eye and a delicate sense of balance, both of which a bird possesses to a high degree. Furthermore, as Matthews points out, correction for a sun arc system would be essentially instinctive, rather than involving great reasoning power.

This lucidly presented summary is essential for those concerned with bird flight, migration and navigation, and will be extremely valuable to all who are seriously interested in birds. Far from being the last word on the subject, this monograph will surely stimulate many new studies in animal physiology and ethology. To me it is fascinating to find that the extremely highly developed balance system of the semicircular canals, which I had assumed to have developed purely in response to the great aerodynamic advantage of unstable flight, may owe its refinement in part to navigational needs.

A topic that is not discussed by Matthews is that of night migration flights. These need not involve true navigation, since the course may be set during daylight, but they do involve holding that course with, apparently, fair accuracy. In this connection I find interesting Matthews' finding that pigeons released in groups orient faster and more accurately than those released singly. Perhaps some such benefit accounts for the group migratory flights of thrushes and wood warblers. It is possible that, where single birds would soon wander far off course under conditions of poor visability, a flock held together by the call notes that we hear on a still autumn night may maintain its direction.

D. B. O. SAVILE

Partners With Nature

By IVAH GREEN. New York and Toronto, D. Van Nostrand Co., Inc., 1951. Illus., 112 p. $2.20.

This is a book on conservation for boys and girls in the middle and higher grades of the elementary schools. Its theme is that there is an orderliness in nature with which men should integrate their activities if the land is to remain healthy and capable of supporting men, other animals, and plants in balanced harmony.

The author is supervisor of over 5,000 rural schools in Iowa and was formerly on the staff of the State Teachers College at St. Cloud, Minnesota. That background, coupled with her obvious interest in and awareness of ecology and its practical applications, well qualifies her to write such a book.

The first chapter of *Partners With Nature* is titled "It's Hard Work to Stay Alive" and deals with adaptations of animals and plants to their environment. Their interdependency of living things, the water cycle, and the relation of man to 'nature's balance' are other general topics which are carefully presented with interest-catching examples. Well-known birds, mammals, insects, and plants and their relationships with each other and with man are the subject matter of other chapters of the book.

The importance of soil and water conservation is stressed and basic techniques applicable to each are well described. The illustrations in this section are particularly effective. The final chapter contains practical suggestions for conservation projects which youngsters can undertake. At the end of most chapters there are suggestions for additional reading.

Partners With Nature is written in a fashion which most young people will not find difficult and should enjoy. Most of the animals and plants mentioned are those that are typical of the United States Middle West and, to a lesser extent, southern Ontario and Quebec. There are only a few references to the seas, the seashores, the northern forests, the arctic or the tropics. However, there is little doubt that the lessons most easily learned are those that refer to familiar situations, and while the book's area of usefulness is thereby somewhat limited, its influence within its region of primary interest is probably enhanced.

DAVID A. MUNRO

Arctic Birds of Canada

By L. L. SNYDER. Illus. by T. M. SHORTT. Toronto, University of Toronto Press, 1957. 310 p. $4.75.

Because of the rapidly increasing numbers of people visiting or living in the Arctic there is a growing need for books dealing with the natural history of the north. The volume under review makes a substantial contribution towards providing an understanding of our arctic birds. Seventy-two species are treated in detail, and an appendix records the occasional or accidental occurrence of ninety-three others. The major species are discussed under the headings: Additional Names (English and Eskimo common names), Status, Habitat, Characteristics, and Remarks. Each is beautifully illustrated in black and white by Mr. Shortt who shows a wonderful appreciation of arctic habitats. Although I doubt whether the manner of presentation would allow easy identification by a beginner, this book will be a useful supplement to a field guide. There is an unnecessary amount of repetition of information presented under Status in the sections on Habitat and Remarks. If the space thus used had been devoted to information on breeding calls, courtship and food, the usefulness and interest of the book might have been greatly enhanced. As it is the text fails to provide a mental picture of the birds on their breeding grounds.

The format and printing are good and the text seems to be very free of typographical errors. Unfortunately there are more errors of fact than seem to be justified. For example the map for the Red-throated Loon is seriously in error for the southeast part. The ranges of *Charadrius hiaticula* and *Acanthis h. hornemanni* are not shown to include Alert, although these records were published in 1953. The same source gives some Ellesmere dates for the European Knot although Snyder deplores the lack of such information. Although this paper is absent from the bibliography it is curious to note that data from it are plotted in the Knot and Ruddy Turnstone maps. *Passerculus sandwichensis anthinus* is omitted from the map although it occupies about a third of the arctic and subarctic range of the species. The words "right" and "left" are transposed in the legend of the Sabine Gull illustration. In early breeding seasons the Whimbrel often reaches southeastern Canada in late July. *Branta canadensis interior* is given as *B. c. ungava*, and *B. c. leucopareia* of the Aleutians is "supposed to occupy the extreme western Canadian Arctic." Rock Sandpiper is stated to be appropriate for the Purple Sandpiper, but it is already in use for the related *Erolia ptilocnemis*. Finally, readers unfamiliar with the arctic should be warned against the inference on page 10 that it supports a dense population of birds. Breeding censuses show that scarcely any habitats in North America support as low populations as arctic tundra, and that many carry five to ten or even twenty times as many birds. Despite such slips, however, this is an attractive and useful book.

D. B. O. SAVILE

Introduction to Agronomy

By R. S. DUNHAM. New York, The Dryden Press, 1957. 324 p. illus. $4.50.

This compact volume will give the beginner-student and the general reader a brief but satisfactory introduction to the science of agronomy. The experience and knowledge of the author, acquired by many years of teaching and research, are reflected in the clear and intelligent presentation of the main principles and practices of crop production and field management.

The book contains four main parts. The first part considers the agronomist and his crops. Treatment of individual crops is rather brief but the author has provided excellent references. The second part is headed "the agronomist and his soils." It contains a description of the physical, chemical, and biological composition of soils and includes a discussion on soil management. The information provided is more than adequate for the general reader. The third part covers production factors and contains chapters on crop rotation, water and light and temperature requirements. The data provided to explain basic facts and principles are simple but effective and easily understandable. The last part of the book covers production hazards which include diseases, insects and weeds. Information has been held to a minimum without sacrificing clarity.

The book is nicely illustrated and well written. However the Canadian reader may be slightly disappointed, in the first part of this book, to find such a scarcity of references to Canadian agriculture.

A. G. PLESSERS

Marine Algae of the Northeastern Coast of North America

By WILLIAM RANDOLPH TAYLOR. Illustrated by CHIN-CHIH JAO. Second revised ed. Ann Arbor, Univ. of Michigan Press, 1957. 509 p. (Univ. of Michigan Studies, Scientific Series, v. 13) $12.50.

This second revised edition by the greatest living authority on the taxonomy of the marine algae of this region has been eagerly awaited by the marine botanists in the area and will be welcomed by phycologists everywhere.

As is his custom, Dr. Taylor has prepared the work with infinite care and it is evident that all changes have been made as the result of considered judgment. The interesting section on geographical distribution has been revised to incorporate results of investigations made since the publication of the first edition. The author divides the coast into several broad geographical regions and lists the commoner algae typical for each portion. He points out that both the range and association of many species are "not quite as in Europe." The reader is reminded that algal fluctuation from year to year is very common and that there are local exceptions to the general trend.

The section entitled "Algal Habitats" deals briefly with the characters of the vegetation in different parts of the territory. A general description is given of the changing flora as one advances up the coast from the south, the character of the flora changing with the type of coast line as well as with increasing latitude. The ecological districts described are: southern part of range to northern New Jersey; Long Island Sound, Cape Cod and its offshore islands; northern New England and the Maritime Provinces (not including the shores bordering the Gulf of St. Lawrence and Northumberland Strait); the St. Lawrence River, and a most northerly region including Hudson Bay, Hudson Strait, Ungava Bay and the northern tip of Labrador.

Of special interest to eastern Canadians is the discussion of the results of recent investigations on the flora of Ungava Bay and Killinek Island. Many of the common species are given with descriptions of their size and levels of growth. This new feature in the discussion of our northern algal habitats is a most important addition to the literature. The account, though necessarily brief, presents a clear picture of the flora in its changing seasonal environment and makes possible an interesting comparison with the flora of the Maritime Provinces particularly in those areas subjected to ice action with the approach of spring.

In describing the ecology of northern New England and the Maritime Provinces, the author comments that on the broad tidal flats in parts of the Bay of Fundy, "the rockweed vegetation shows *Fucus edentatus* as an important item with *F. spiralis* and *F. vesiculosus* to the south." To this reviewer the statement is not clear because on both the Fundy and the Atlantic shores of the Maritime Provinces one finds all three species of *Fucus* to be generally important in the rockweed flora, the relative abundance and the size of plants being dependent on the degree of exposure. In many areas not subject to excessive exposure *Ascophyllum nodosum* forms at least eighty percent by weight of the luxuriant rockweed vegetation.

In a description of the coast of northern New England and the Maritime Provinces, *Chondrus* could also have had special mention as an important constituent of the flora. It is evident that the literature cited has made insufficient mention of this plant which grows so abundantly in extensive pure stands on many parts of our coast and from which a commercial harvest of many tons is taken annually.

The section on "Preservation and Collection" cannot be recommended too highly. It is a masterpiece of careful and thoughtful directions, and has been extended and altered in accordance with the author's additional experience since the earlier publication. It could have been written only by an enthusiastic and discriminating collector of wide experience. Detailed directions are given for collecting, preserving, shipping, and storing algae of different types. Any one desirous of making permanent collections or field studies is earnestly advised to note this section with care. By doing so he will be saved much time and many lost specimens.

The "Historical Survey" remains practically unchanged but the section concerned with "Purposes and Limitations" has been considerably altered. Among other things the author explains the omission of certain data and their supporting citations of source literature, which have been deleted from the Descriptive Catalogue.

A few additional species have been added to the Systematic List, and certain changes have been made in classification and nomenclature. Like the list in the earlier edition this one fulfills the author's purpose of providing a check list of genera and species conveniently arranged. Varieties and forms other than the typical ones have been deleted from the new list, but appear in the Descriptive Catalogue which follows.

As in any taxonomic manual, the most substantial part of the book is the Descriptive Catalogue. This catalogue is the most up-to-date list available and, except for the first edition now out of print, the only comprehensive one for this coast. It will be in constant use by students and a necessity for any serious work on the algae of this region.

Alterations have been made in keys, descriptive passages, references and notes. Although many keys remain as before, many others of all degrees have been altered to a greater or less extent in accordance with reclassification, or to allow for additions or deletions of genera and species, or for greater exactness. The key to the orders has been altered to include *Xanthophyceae*; that to the families of *Phaeophyceae* has been removed altogether.

Occasionaly a key has been completely redesigned upon a different basis. An interesting example is the new key to the *Achrochaetiaceae* based largely on the nature of the chromatophore. A footnote informs the reader that this new key, suitable for fresh material, may prove difficult with preserved specimens. In this case, the note suggests that it may be more convenient to use the key to the *species* in the earlier edition.

Always the changes tend to increase clarity and thus make for easier determinations. No word has gone unchecked and the rewriting has been done with the extreme care so characteristic of the author.

The same care has been exercised in rewriting the descriptive passages, where the alterations are of two kinds. The first, occurring regularly throughout the Catalogue, eliminates the "less necessary data" on morphology and life histories because of the greater availability of good morphological books which have appeared since the earlier edition. This may be a little disappointing to many of those using the book as a college reference text, but to have included all the new data would have resulted in a volume of unwieldy proportions.

The descriptive passages themselves have been improved by slight alterations in detail; this second change results in greater accuracy.

Hauch and Richter's *Phycotheca Universalis* has been added to the important collections of American algae to which citations are given. The addition of sixty-one new bibliographical references and the deletion of one hundred and seventy-six others result in a bibliography dealing with literature pertinent to algae of the area.

The few errors have been corrected. For example, *Isthmoploea sphaerophora* (Harvey) Kjellman and *Laminaria digitata* (Linnaeus) Edmonson have been changed to read *Isthmoploea sphaerophora* (Carmichael) Kjellman and *Laminaria digitata* (Linnaeus) Lamouroux.

Footnotes and other explanatory notes add interesting and valuable material to the text.

The sixty plates and descriptions of many of the genera and species commonly found in the area depict the habit, manner and details of branching, details of cell structure and arrangement, anatomy and modes of reproduction. Only a few alterations appear in the plates.

The book is well indexed. A short glossary would have been of convenience to many students. The revision of this valuable book and especially of the Catalogue has been a tremendous undertaking, only slightly less than that of the preparation of the first edition. Botanists everywhere will be grateful to the author.

CONSTANCE MACFARLANE

Snakes and Snake Hunting

By CARL KAUFFELD. Garden City, Hanover House, 1957. 266 p., illus. $4.75.

Many people spend their weekends and holidays pursuing a favorite pastime which they find stimulating, satisfying, and thrilling. Skin diving, mountain climbing and exploring caves are popular but Carl Kauffeld introduces us to a different one: hunting and capturing snakes, especially poisonous ones.

Mr. Kauffeld, Curator of Reptiles at the Staten Island Zoo, has been a snake hunting enthusiast since childhood. His book recounts many of his adventures in the New England States (where, he points out, poisonous snakes are more easily caught in quantity than in any other area in North America), in the southeastern United States and in arid Arizona where there are no less than 18 kinds of rattlesnakes.

As Mr. Kauffeld presents it, snake hunting is a thrilling sport, the only hunting equipment necessary being some knowledge of the habits of snakes, a sharp eye (a Copperhead Snake on a mat of leaves is as difficult to spot as a Woodchuk on her nest), a cloth bag, a snake hook and a steady hand for seizing poisonous species at the neck. He tells of the best type of habitat in which to expect to find different species of snakes, and once in a snakey area his rule of thumb is to leave no stone unturned. He sagely advises the pursuit of garter snakes and water snakes for the novice. However, the aspiring snake hunter's goal should always be to spot and bag alive a magnificent five-foot Eastern Diamondback Rattlesnake. With the feelings of a true hunter Mr. Kauffeld reiterates that each capture is slightly different than the last and always as thrilling as the first.

A keen observer, the author describes the regional variations in color, size and, surprisingly enough, temperament that he has encountered in many snake species and genera. He has had such a wealth of experience in this respect that when hunting he expects the unexpected and usually is rewarded. Collecting at night by driving along highways and searching for reptiles soaking up the stored heat from the pavement is as full of suspense, thrills and surprises as any daylight hunting expedition. However, his interests are not solely centered on the capture of snakes for he tells of many other interesting animals encountered and of the sights, sounds and smells of the different habitats in which he has hunted.

The volume is illustrated with superb black-and-white photographs of snakes and several show the author in the act of manipulating live rattlers. In addition, there are included in the text a number of poems on snakes by E. Coatsworth, Bret Harte, and J. T. Nichols. The final chapter is most commendable for the author makes a well-founded plea for conservation of snakes. His goal is to see the formation of a "Holbrook Society" which would be akin to the "Audubon Society" in aim and scope. Snake studying groups would develop, and through the observations of these amateurs our knowledge and appreciation of snakes for their own sake would grow immensely.

The only index is a useful list of over 260 amphibians and reptiles with the page numbers where they are mentioned in the text.

After reading *Snakes and Snake Hunting* this reviewer is left with the feeling that the author has restrained himself considerably in writing the book. His style is descriptive without any dialogue which in a book about hunting stories is unforgivable. Hunters are a distinct class of people and their conversations and idiomatic expressions are what make them come alive in a book. Here again Mr. Kauffeld has failed, for in every instance where a colorful, colloquial or typical hunting expression is used, he embalms it in quotation marks, making it appear that the word or phrase is really not properly employed and that he himself is using it only out of necessity. I hope that Mr. Kauffeld writes another book, but writes it as if he were addressing his fellow hunters in hunting language.

SHERMAN BLEAKNEY

A Laboratory and Field Manual of Ornithology

By OLIN SEWALL PETTINGILL, JR. Minneapolis, Burgess Pub. Co., 3d ed. 1956. 379 p., 23 plates. $5.00.

Pettingill's *Manual* is a compilation of significant information concerning birds together with directions on how birds should be studied at the college or university level. The excellence of the second edition is indicated by the fact that it was adopted by more than one hundred colleges and universities in the United States. This, the third edition, is considerably better than the two previous ones. Its scope has been extended to include a wider coverage of ornithological work in other parts of the world. A particular effort has been made to make it as useful in Canada as it is in the United States.

The new edition has twenty sections which are devoted to such aspects of bird study as the topography of birds, feathers and feather tracts, anatomy and physiology, systematics, external structural characters, laboratory identification, plumages and plumage coloration, distribution, migration, field identification, bird ecology, bird communities, territory, song, mating, nests and nest building, eggs and incubation, development of the young, parental care, and bird populations. Each of these sections has a well-organized and clearly written text which is adequately illustrated with line drawings, and in each there are logically conceived directions for study. Most sections close with a very useful list of references to related literature.

In addition there are seven appendices. These contain instructions on ornithological field methods and the preparation of manuscripts; bibliographies pertaining more or less to ornithology; bibliographies of life history studies; a selected bibliography (by states and provinces) of North American works on birds and including also references to Alaska, Hawaii, Greenland, St. Pierre and Miquelon Islands, Mexico, and the West Indies; lists of books containing general information on birds; and a compilation of current ornithological journals of the world. Finally, there is a good index.

The author and the publishers may well be congratulated on making available at a reasonable price so much useful, up-to-date information on the study of birds.

W. EARL GODFREY

Letters to the Editor

Serious letters on natural history or on topics arising out of articles in this journal will be considered for publication in this section.

Local Publications Needed

I have, for the last year, been reviewing the spread of the European Starling in Canada. This has taken me back to the year 1927 when Dr. Harrison Lewis published the known breeding range of the bird in Ontario. Since then it has spread as far west as Juneau, Alaska. The sources I could tap for published references were the *Canadian Field-Naturalist*, the *Auk*, *Condor*, *Wilson Bulletin* and *Murrelet*, the reports and publications of the National Museum of Canada, the Royal Ontario Museum, the B.C. Provincial Museum and the Royal Canadian Institute, also one or two publications which are not primarily concerned with outdoor natural history, or with birds, such as the *University of Toronto Studies* and the *Proceedings of the Nova Scotian Institute of Science*. There were also books on the birds of British Columbia, Ontario, New Brunswick and Newfoundland. I may only say that all these publications produced a minimum of starling reports, but enough to provide a broad outline of its range expansion.

In an attempt to seek further I have carried out a wide correspondence seeking unpublished records from all the western provinces, and Ontario. An appeal in the *Blue Jay*, the organ of the Saskatchewan Natural History Society, resulted in a number of readers writing to the editors or myself with reports of starlings, some of which went back to the early days. For Manitoba the earliest records were to be found in *Chickadee Notes*, the nature column of the *Winnipeg Free Press*, which was so ably edited by Mr. A. G. Lawrence, for (he tells me) 33 years. But apart from these local forces, and the help of the directors of provincial museums (note: Alberta still does not have one), I have been dependent upon discovering, and writing to, amateur naturalists in all regions: interior British Columbia, northern Alberta and Saskatchewan, northern and western Ontario.

I have had time, therefore, to ponder on the lack of organisation among the 'private' naturalists of Canada, among the farmers and foresters, and among the participants of the cult of the outdoors. It has been highly significant that the earliest and most reliable records of the starling came from expatriates, English, Scottish and Continental (who of course knew the starling). These, and other naturalists, exist in their hundreds across Canada, and no doubt many are readers of the *Canadian Field-Naturalist*. I suggest, however, that a comparison of the subscription lists of the *C.F-N.* and the *Blue Jay* might be revealing.

There is a need, I believe, both from the professional angle (here I was trying to amass the observations of the amateurs, which would otherwise have been lost to science), and from the point of view of social relationships among the scattered amateurs themselves, for local publications of *scientific repute*. It is true to say, I think, that notes on birds (having local significance only) can only be published in British Columbia in the *Murrelet* (an American publication). There are one or two other publications by local societies, but so far they have no pretensions to add to scientific knowledge, in the way the *Blue Jay* has. Yet, my correspondence showed that there are a great many people with worth-while observations who would publish them were there a local report to which they could be submitted. You, as an editor, may say that this will reduce your custom. But I do not think that that is the point. Reports of vagrant birds do not add anything to Canadian ornithology when reported in the *Canadian Field-Naturalist*, but they do have local (I think I mean provincial) significance. The first record for the starling in British Columbia was reported in the *C.F-N.*, but it need not have been. Possibly the *C.F-N.*, will (now that it is no longer running behind time in publication) concentrate on matters of all-Canadian interest.

In this matter I am suggesting a model based on the system operating in England. There *British Birds* has the position (among ornithologists) that the *C.F-N.* has among naturalists in Canada. It is a respected authority, to which the executives of local societies look for guidance. But almost every English county publishes (annually) its own report, which contains the bird records made within the county during the year, by persons living there. If a survey, like mine on the starling in Canada, is to be conducted, the writer goes through all the local reports to extract detailed records, that could not possibly have been published in *British Birds*, for sheer lack of space. With Canada's steady increase in population the need for local reports (such as the *Blue Jay*) will become greater and greater, if only to take the load off the *Canadian Field-Naturalist*. In the mimeographed broadsheet, the *Canadian Wildlife Newsletter*, circulated among professional 'wildlifers' in Canada there was recently (No. 7, May 1956) a discussion of outlets for publication for wildlife biologists. Outlets for technical articles included the *C.F-N.*, *Canadian Journal of Zoology*, *Le Naturaliste Canadien*, *The Forestry Chronicle*, Canadian Wildlife Service and Ontario government publications, and the *Ontario Field Biologist*. *The Bulletin of the Federation of Ontario Naturalists* was classed, along with *Canadian Nature* (an Audubon Society publication) and *Forest and Outdoors* as an outlet for popular articles. The opinions of a number of wildlife biologists on this topic of outlets for publication were also included in the *Newsletter*.

My own belief is that there is a great need for publications of the type of the *Blue Jay* and *Ontario Field Biologist*, either quarterly or annual publications. For example there is no clear outlet for the dissemination of information on the Nest Record Schemes now being operated in British Columbia (*Condor*, in press) and Ontario (*Federation of Ontario Naturalists Bulletin* No. 76: 26-27, 1957). Yet to make these schemes a success it is necessary that some local journal exists through which contributors may be kept informed, and non-contributors encouraged to participate. These schemes are based on the assumption that the amateur ornithologist *does have* a great deal to contribute to biological knowledge. But there must be a clearing house. It is significant to recall, I think, that in Great Britain, the first or one of the first nations to establish a banding-scheme, the magazine *British Birds* was the originator of the idea in 1909 (*British Birds* 50: 213-239, 1957) and today bird-ringing in Great Britain is still organized by a nongovernmental agency. In North America conditions are different, of course, but in Britain *British Birds* is still the publication outlet for most papers on banding and, until four years ago, was the outlet for all papers based on the Nest Record Scheme. The first Canadian publication, based on a nest record scheme is already in press, in *Condor*. Since it originated in British Columbia may this not be the result of a tendency of the westerner to look south along the coast and along the mountains to California, rather than east to Ottawa? As the perpetrator of this crime, I must admit to having a personal bias that way. But we need in British Columbia a proper outlet for such papers, and I believe the time has come for the *Canadian Field-Naturalist* to re-establish its role as the leading Canadian outlet for papers pertaining to natural history, and to play a leading part (by suggestion, advice, moral support, influence, and facilities) in establishing provincial publications which look towards the *Field-Naturalist* as their guardian. The two spheres of influence would not be competitive, but complementary. Local energy, if one looks for it, can be found. But the initial organization and 'push' must, I believe, come from an established body, with an established reputation. Funds are of course lacking (there is no regular support for the B.C. Nest Records Scheme, for example) but they may be found, I believe, if the *Canadian Field-Naturalist* were to possess a positive editorial policy on such matters, and to try and find funds upon which local organizations could build up their own edifices. I would be glad to see an editorial in the *C.F-N.* on this matter.

M. TIMOTHY MYRES

Vancouver, British Columbia

[Correspondence on this subject is invited.—EDITOR.]

Suksdorfia violacea in B.C.

A. J. Breitung in his recent paper "Plants of Waterton Lakes National Park, Alberta" (Can. Field Nat. 71: 39-71, 1957) cites a collection of this plant with the comment "New to Canada." Possibly this is a slip and "Canada" should read "Alberta," for the species has long been accredited to the flora of B.C.

J. K. Henry's "Flora of Southern British Columbia," published in 1915, records it, as *Hemieva violacea*, from Kaslo, on Kootenay Lake. Unfortunately, Henry's private herbarium met with destruction after his death, so that it is not possible to check his specimen, but there is no reason to doubt the validity of the record; there are four sheets of the plant in the herbarium of the University of British Columbia collected in the Crawford Bay area on Kootenay Lake by

Harold Murray, in 1920 and 1940. There are also collections in this herbarium from Trail (West Kootenay) and Kimberley (East Kootenay).

Another published record is that of Titus Ulke in "Vascular Plants of the Horse-thief Creek — Purcell Range, B.C." (Can. Field Nat. 49: 49-55, 1935). This site is in the Columbia Valley near the north end of Windermere Lake, so that, although the plant is undoubtedly a rarity, it has been found over a wide area of southeastern B.C.

J. W. EASTHAM

Vancouver, British Columbia

Corrections-Volume 71

Page 43, left column, third line from bottom. *For* Spargantaceae *read* Sparganiaceae.
Page 45, *For* Vol. 56, No. 4 *read* Vol. 58, No. 1.
Page 157, right column, 10 lines from bottom. *For* trips *read* slips.

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